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Beni-Hasan.

FOR a good many years past the name of Beni-Hasan (or, as Fergusson spells it, "Beni-Hassan") has been familiar in the ears of every architectural student as connected with the early beginnings of Doric architecture. It is probably entirely to Fergusson that we must trace this general and popular acquaintance with the characteristics of these remarable rock-cut remains of the Nile Valley, and with their significance in architectural history. Others have studied, described, and drawn the Beni-Hasan tombs, with the incompleteness and disregard of accuracy which were characteristic of architectural research in the days of our forefathers; but Fergusson's few general remarks and small woodcut illustrations have been for a whole generation the generally accepted illustration and criticism on a collection of architectural monuments which have a peculiar and almost unique interest and value in their bearing on the origin of the most perfect style of architecture that has, as far as our knowledge goes, ever existed in the world.

We have long felt that modern archæology, with its increased sensitiveness as to accuracy of representation and thoroughness of investigation, ought to have something further to say in regard to Beni-Hasan, and in this first volume of the records of the Archæological Survey in Egypt* we have an admirable commencement of the work, in the true spirit in which such work should be undertaken. Mr. F. L. Griffith, the general editor, in his short preface, says, "Our united aim has been perfection. We are proud even of our partial success, but we are fully conscious that we have not yet raised the work to what should be its ultimate level."

Although, as Mr. Newberry observes, the tombs at Beni-Hasan had been illustrated and described by more than a dozen distinguished Egyptologists, the present expedition has already discovered three tombs hitherto unnoticed, and copied a large quantity of hitherto unpublished drawings and inscriptions; and there appeared to be so much to illustrate that it has been resolved to spread the record over two volumes, of which the first only is now published.

A large proportion of the illustrative plates in this volume are occupied with very careful reductions of the drawings and inscriptions, which are of the highest interest to those who may be called general archæologists, in the light which they throw on Egyptian life and on some of the private history of persons connected with these remains; but of course to architects the interest of these new investigations at Beni-Hasan turns rather on the information they may yield in regard to the origin of the proto-Doric architecture which is illustrated there. The connexion between the forms in these remains, and those of early Doric architecture, can easily be traced in the imagination, though the actual links are wanting. The question is not so much what came after the eight-sided and sixteen-sided pillars of Beni-Hasan as what preceded them; and the greatest value of new investigation there to architects would be in the discovery of any hitherto unobserved details which would furnish additional information or suggestion as to the origin of the Beni-Hasan forms.

Fergusson considered that the remains at Beni-Hasan showed evidence of having been borrowed from brick architecture; his argument being that the thin tile shown on the top of the octagonal and sixteen-sided columns was just what would be necessary to give the proper seating for the beam on a brick column; that the column itself might have been built up with bricks, and that the segmental arched form of the ceiling was an imitation of an arched brick roof. He also adds that the cornice indicates a lighter style of architecture than could be derived from stone buildings. It is of interest to see whether the new volume on Beni-Hasan throws a fresh light on these points.

Mr. Newberry classes the tombs (we will assume that they are tombs) under three heads: (1) halls without columns or portico; (2) those without portico, but with a roof supported by lotus-bud columns, and formed in the shape of segmental arches; (3) those with an outer court, a portico, a chamber divided into three aisles by sixteen-sided fluted columns, also with ceilings of curved sections. It would be a very great point if we could discover any marked difference of date between the tombs with the lotus capital columns and those with the fluted columns and plain abacus. The two features are so entirely different, and point to such a different origin, that one must consider them from quite a different point of view. In the present volume no lotus-column tombs are illustrated, and we must wait for the second volume for their fuller consideration, but we may point it out as a very important object for the explorers, to look carefully for any indications of difference of date between the caves showing these two very distinct types of column. At the same time we doubt whether it is likely that any important difference in date will be made out. The whole set seem so far to belong to one group and one period (about 2500 to 2300 B.C.), and the similarity of the arched roof in both classes of tomb seems also to connect them closely.

The most important tomb illustrated in the present volume is that distinguished as No. 2. We have here a fore-court with two eight-sided columns in front of the entrance to the inner chamber, supporting a beam form parallel with the front of the inner chamber, and a segmental arched roof parallel to the beam, between it and the inner chamber wall. The inner chamber is divided into three aisles at right angles with its front, by two sixteen-sided columns on each side of the centre aisle, also carrying imitation beams, and three segmental waggon vaults over the three aisles, between the beams. All the columns stand on the well-known wide, flat, circular Egyptian base, and all carry square abaci forms worked out of the beam. In the eight-sided columns there is no attempt at fluting; in the sixteen-sided ones there is a very slight curved depression of each face, evidently not done to obtain the decorative effect of a fluting, but merely to emphasise the edges slightly, which would otherwise be at too obtuse an angle to be very marked in their effect. It is noticeable that the only other pillared tomb of which a plan is given (No. 14) has two circular columns, and a flat roof; and

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* Beni-Hasan; Part I. By Percy E. Newberry. With Plans and Measurements of the Tombs by G. Willoughby Fraser, F.S.A. With forty-nine Plates. Published under the auspices of the Egypt Exploration Fund. London: Kegan Paul, Trench, Trübner & Co.; 1893.

moreover that the bases of these have much less projection than the usual Egyptian base.

Studying No. 2 tomb, one would hesitate to accept Fergusson's theory that the columns are imitations of brick-built structure. The building up of brick columns in the sixteen-sided form would be a matter of some difficulty and elaboration. We should be more disposed to regard them as derived from wooden pillars, the edges of which could be easily taken off, to reduce them to eight or to sixteen-sided posts for improved effect merely, and the wide-spreading base-plate seems just what is necessary to give them a good foundation and prevent them from sinking in the soil. On the other hand, it seems quite impossible to regard the segmental section of the ceilings as other than an imitation of a built arch, very likely of brick. One cannot imagine any other motive for this formation of the ceilings in a rock-cut chamber. If this view is accepted, we are here brought round again to a wooden origin for the Doric column as well as the entablature; an origin which has been rather discredited on account of the fact that the earliest genuine Doric — archaic Doric — shows columns of thicker proportions than the later and more refined Doric order. But the interval, both architecturally and chronologically, between the columns of Beni-Hasan and those of Corinth and Segeste, is very great, and we have at present none of the connecting links between them. We should suggest to those who are conducting the explorations at Beni-Hasan to keep a lookout for any fact, either in the remains themselves or in the inscriptions or paintings on their walls, which will throw any light on the question whether these eight-sided and sixteen-sided columns are imitated from wooden or from masonic forms. The question is of the greatest interest in regard to the history of the origin of Doric architecture. In the meantime we may congratulate the members of the survey, to whom we owe this volume, on the admirable and conscientious work of illustration which they have carried out thus far, and the sequel of which will be looked for with the greatest interest.

THE LATEST CRAZE IN ARCHITECTURAL DRAWING.

EVERY style of art undergoes changes and is influenced by the taste, or want of taste, of the age through which it passes. This must always be the case where there is that kind of civilisation which has prevailed in Europe for the last thousand years, and it is one of the essential characteristics which distinguish Western from Eastern art. The latter, though often remarkably beautiful, yet is to a certain extent monotonous, owing to its want of mobility and the absence of that power of development which is essential to all true life in Art. Of course, all growth is not growth, and all change is not necessarily improvement, so it must often happen that what is at first regarded as advance and development of the right kind, or as original treatment, may be discovered after a while to be nothing but eccentricity and affectation. How this is to be detected and arrested is a question which has constantly exercised the wisdom and ingenuity of artists and art critics.

Some writers have attempted to settle the question by saying "appeal to Nature," which is simply begging the whole question, because all these various methods in art spring either directly or indirectly from the study of Nature, and to tell a man that he is to "copy Nature" is about as valuable a piece of advice as to inform him that if he wants to become an artist he must learn to draw. In drawing and painting we cannot possibly reproduce Nature, because we have to reduce to a flat surface that which is really solid, and we have to represent light by paint; so that here we are brought face to face with two perfectly insurmountable difficulties, a "plane superfices" to represent solidity, and a solid substance to appear atmospheric; and which is the right solution of the problem, which is the best representation of Nature, to draw an object flatly, filling in an outlined space with colour as all early painters did, and as it is still done by Eastern nations; or by certain conventional exaggerations—darkening in the background, losing the outline here and there, increasing the lights and intensifying the shadows, to produce a modern portrait of the approved academical type? Who shall say which of these is the true representation; and are not both purely conventional imitations of Nature? The latter appeals to us, because it is that which we are accustomed to see; but it is much to be doubted whether it would, if we were not trained to regard it as right. We once read an account of some missionaries who were going to visit an uncivilised tribe of Indians, who, from their carvings and drawings, seemed to possess an instinctive perception of art; so the missionaries thought that some good reproductions of well-known modern pictures might interest these natives, and accordingly provided themselves with a number, which in due time they presented to various members of the tribe. The missionaries were, however, considerably disappointed some time after when, upon visiting these people, they found most of the pictures hung with the heads downwards, some placed sideways, and only a few (accidentally) the proper way up. Which shows that to the unsophisticated mind of a savage our method of representing objects is totally unintelligible, and shows also how difficult it is to form an opinion upon any new departure in art. There are, however, a few tests which may be offered and certain conditions which must be fulfilled in all imitative arts, such as drawing, painting, &c. The draughtsman must, in the first place, show that he knows the form, character, construction, and condition of the object he is representing; whatever method he uses, he must convince the person who looks at his drawing that he has the power of impressing these points upon the mind. We must be able to see the form of the object, to realise its construction, and to receive a true idea of its character and condition. Say for instance it is a head; there must be no doubt left upon the mind whether it is that of an old or a young person, whether it is in a state of health or decay. To represent youth or hearty middle age with the marks of extreme old age would, we feel, be morbid and vicious, and to insist strongly upon such marks of decay where they should not exist is a monstrosity.

Yet this is precisely what those who have adopted the latest craze in architectural drawing are doing. We do not deny that several of these men have shown themselves to be accomplished draughtsmen, and have produced interesting and attractive work; but we do protest against every building, whether ancient or modern, whether in a good or bad state of repair, being represented as in an advanced state of decay. We have before us a view of the interior of a French cathedral, which is in reality as sound as the day it was erected (about the end of the thirteenth century), the masonry joints are quite clean and true, the mouldings sharp and unbroken, the capitals perfect, the arches and vaulting ribs free from fractures, the soffit of the vault neatly plastered without a crack in it, the pavement regular and in good order; the whole giving one the impression of a well-preserved, thoroughly-serviceable building. Now, how is all this represented in the drawing before us? The columns have huge gaping joints from which the mortar has fallen out; they are from cap to base a heterogeneous mass of chips, cracks, crevices, chinks, and crannies; the mouldings are an indistinguishable mass of scarred and splintered stone work, the vaulting ribs are broken, and plaster from the soffit of the vault has for the most part come down, showing behind it some rough brick construction which would disgrace a coal-cellar, and in such a dangerous condition that no one who valued his life would care to venture beneath it; *walk* he could not, because the pavement is so perforated with holes and pitfalls that it would be dangerous to attempt it. Yet what is gained by all this exaggerated and nonsensical misrepresentation of an impossible condition of decay? Well, we may sum it all up in the words of a guide who once showed us over a castle, and, coming to a piece of tapestry representing some mythological scene—"This," said he, "ladies and gentlemen, his a hold, hancient, hantiquated mythe!" Another drawing which we have before us (of course we refer to reproductions of drawings) is supposed to represent a Roman Basilica church, the columns and arches of which, when we saw it a few years back, were perfectly upright and "true"; but one could not even use Mark Twain's description of a Damascus rifle-barrel concerning them, as represented in the drawing, "that it was straighter than a corkscrew, but far less so than a rainbow," for here the columns are shown wriggling about as if they had a sharp attack of "St. Vitus's dance," or were reflected in the rippled surface of some very lively river. In another of these illustrations we find Westminster Abbey represented with a roof ridge which would form an appropriate outline to a dromedary's back or a chain of mountains. We find representations of well-known cathedrals, churches, mansions, &c. (which are really in excellent repair), shown in such an alarming condition that the District Surveyor must have been criminally negligent of his duty not to have ordered their destruction long ago.

But if this craze for exaggerating the appearance of decay in ancient buildings is absurd and false, what is to be said of its employment in depicting quite new buildings? Yet even this fashion is being introduced by some of these gentlemen of the new school, and a few weeks back we noticed a reproduction of a drawing of a brand-new London church, which was to be opened the next week, shown in such a very advanced condition of decay and of hoary antiquity that a fine sturdy branch of ivy had forced its way through the glass of one of the clearstory windows, and its graceful twigs and leaves were creeping up the vaulting ribs. We should hardly have thought that the modern builder would have tended the ivy so carefully, and we wish we could obtain the receipt for making the plant grow so rapidly; it must have made a growth of at least 45 ft. in thirteen months, which would be considered phenomenal even in the East, where strange things of this kind happen. In other drawings we find modern buildings, banks, club houses, hotels, restaurants, &c., in London, represented with great putlog-holes left open and birds flying backwards and forwards to their nests; a sweet look of rustic simplicity pervades the whole scene; Phyllis and Corydon may be discovered feeding the songsters out of the attic windows of the bank. Is yon distant spire the village church within whose sacred fane these lovers will ere long be united? and is the moss-grown path beneath, the typical rose-bordered road to happiness? or are they, oh name it not! Saint Giles's "in the Fields" and High Holborn? Putlog-holes, however, are not the only uncomfortable features represented by this school of draughtsmen when drawing new buildings; for we notice that every roof has a tile off or loose; perhaps a poetical emblem of the school itself.

But to regard the matter seriously, let us inquire what this kind of architectural drawing is leading to; what it is doing in the way of instructing the public; how it is affecting architecture; and how far it is worthy of being regarded as serious, earnest, and honest work? In the first place, that art which depicts mere decay and its phenomena must be morbid, because decay is a thing to

be avoided: yes, even in architecture. Are not our architectural students now frequently going to Spain and out-of-the-way parts of Germany in order that they may study the interiors of churches and cathedrals which have escaped the ravages of time and the mutilations of the destroyer? During the very best periods of painting, the fifteenth and sixteenth centuries, did the great artists ever represent decay or ruin in buildings? On the contrary, the architecture represented in the backgrounds of Memling's or Van Eyck's pictures, the most elaborate and correct as to detail, is never decayed or ruinous. The same will be found to be the case with Crivelli, Signorelli, the early works of Raffaelle, &c. These men were able to appreciate the picturesque beauties of architecture from an architectural point of view, and the people of their time were taught by them to regard it as a fine art, "the art of building"; they did not look upon their exquisite churches and houses as mere objects to attract decay, or, like Stilton cheeses, to be manipulated in such a way as to bring about premature rottenness.

The French have a modern school of novelists and poets who delight in depicting decay, disease, and loathsome spectacles; but these French novelists have at any rate the excuse that they describe and depict the terrible scenes and repulsive models correctly. The new school of architectural draughtsmen cannot claim this merit, because they are *not* true to their models and scenes, and if they desire to be considered true depictors, they ought only to draw buildings which are really in a ruinous condition, and not add these blemishes to buildings which have fortunately escaped them. Of course, all this exaggeration of decay naturally leads the public to suppose that there is no real or true picturesqueness in architecture apart from decay, and that all its artistic qualities depend upon the particular fractures and injuries brought about by a condition of insecurity and rottenness; and so they are taught to overlook the noble picturesqueness which is brought about by powerful or artistic treatment, just combinations of light and shadow, or those contrasts which form "the gloom and the glory of a grand building." All this is ignored for some chips in the stonework or some broken tiles on the roof, and thus the public are encouraged to take a childish, or, rather, a senile, view of the art of architecture.

Then again, the kind of picturesqueness which these draughtsmen represent cannot be found in any building which is in use; and the public jumps at the conclusion that the practical and the picturesque cannot co-exist in the same building, and that the latter quality is only to be sought out or looked for in structures which are intended to be ornamental, or such as are preserved as vestiges of antiquity.

Another great danger which arises from this kind of drawing is that the exaggerated representation of decay may, and too often does, become a mere cloak to conceal slovenly and incorrect drawing, and a want of architectural knowledge, both as to construction and detail. We are led to this conclusion because we have observed that not unfrequently the gaping joints occur where, in reality, there would not be a joint at all; and difficult little bits of detail are got over by being shown in a very fragmentary condition. Now, of course, when landscape painters and others find that architectural detail and construction may be played tricks with in this manner, provided that a sufficient amount of decay is turned on, why should they not all become architectural draughtsmen, and why not eliminate every architectural feature and reduce the whole to an indiscriminate jumble of cracks and fissures? Let each schoolboy only learn the "dot-and-wriggle trick," make himself a joggled-ruler, and not trouble himself about detail and construction; then the new school will have succeeded in reducing architectural drawing from a difficult but beautiful art, to a degraded combination of tricks and dodges, which will be of no value whatever to the architect, the student, or the public.

We trust, however, that before long a reaction against this "chippy" style may set in, that the kind of drawing which demands "joggled rulers" and "dotty dodges" may be abandoned, and that in its place we may once again see careful detail drawing, showing a knowledge of construction combined with artistic and accurate rendering of the effects of light and shadow, and that regard for truthfulness and absence of exaggeration which should be marked features in all true works of art.

NOTES.

SOME recent proceedings at the London County Council have not been calculated to increase the confidence of the Metropolis in that body. A vote to petition Parliament in favour of the Local Veto Bill was carried, though it is difficult to see why, if the Council petition either for or against the Bill, they should not do the same in respect of almost any measure before Parliament. A motion that the Council should contribute half the cost (a sum of 44,000*l.* odd) of widening Ludgate-hill, was met by a hostile amendment, which was carried, to the effect that the Council was not prepared to contribute towards the cost of these City improvements. Then a recommendation of the Special Committee as to fair wages was agreed to. This was to the effect that in all contracts for the supply of raw material, or manufactured articles, a condition shall be inserted that the contractor will pay the Council's rate of wages if the articles are manufactured within twenty miles of Charing-cross, or the Trade Union rate in case of articles manufactured outside that radius. It would not be a bit more Quixotic for any man in the street to go into a shop to buy a hat, and on finding that the wages paid to the hands by whom it was made were less than he thought proper to offer to pay such a price as he considered would properly remunerate them. The County Council was not elected to act as guardians of the workmen of Great Britain, but to manage the affairs of London with efficiency and economy.

THOSE who are interested in Colonial building materials will do well to go to the Imperial Institute, and to select a quiet day for the visit. The exhibits in the museum galleries are not all arranged, though a desperate attempt was made to get them into order by the 17th inst., when the governing body, with the Prince of Wales at its head, gave a reception, but there is more than enough finished to warrant a preliminary inspection. The various woods and building stones are, for the most part, the same as were shown at the Colonial and Indian Exhibition, but they can be seen to better advantage in their present home. In an Indian-Ceylon gallery we noticed some examples of building stones, the majority of which appeared to be excellent materials, though two or three certainly were of a very poor description, and not worth exhibition. The fine display of woods in the same section also might have been considerably improved by the judicious weeding out of certain pieces which, evidently, were fashioned before the timber was in a fit condition. Perhaps no part of the galleries claims, at the present stage, more attention than that devoted to the economic products from the Australasian colonies. These are in good order, generally, though we hope to see the exhibits labelled with more information eventually. Building stones and marbles form prominent objects, occupying central spaces in two or three of these Colonial departments, but we are at a loss to understand why the samples should have been cemented together in the form of trophies. We take it that one of the objects of the Institute is to illustrate the ever-changing products of each country, and to keep them up to date, as far as possible. The rapid development of our colonies must of necessity lead to the extensive employment in the near future of other building stones than those at present known, whilst several now in use must in course of time be discarded; and no one would pretend that the series on view is as representative as could be desired. By making the exhibits into permanent objects it is hard to see where any new arrivals can be placed to be systematically classified; it rather looks as though no important changes were contemplated—no further attempt to be made to make the collection more comprehensive and useful—but we trust we are mistaken as to this. The samples of timber in the Australasian Gallery are remarkably good, and well illustrate the indigenous varieties of each Colony. The magnificent specimens of "Jarrah" in the Western Australian division recall to our mind the fact that much of the wood pavement at present laid down in London and elsewhere is constructed of this hard material. Referring to another matter, we are sorry to see that the executive of the Institute have announced that a band of music will be in daily attendance; that occasional vocal and instrumental concerts will be given; and that the amusements on Saturdays will be more lengthened than on other days. This seems like an attempt to transform an institution which was intended for serious objects into a mere place of popular amusement.

WE have received a circular from Sir Douglas Galton, dating from University College, calling attention to the formal opening next Monday, by the Duke of Connaught, of the new Mechanical and Electrical Engineering Laboratories for University College, which have been in course of erection for the last ten months, and at the opening of which "many distinguished persons" are to be present. We shall be fully prepared to do justice to the arrangements of the new laboratory when the day comes; in the meantime, let us call the attention of Sir Douglas Galton and others who are concerned in the matter to the architectural defacement of the College produced in the erection of these new laboratories—a matter which they seem to have overlooked or to regard as of no consequence. University College is the best work of Wilkins, an English architect of some note. Its central façade and return wings, the latter very well carried out in harmony with the original design by Professor Hayter Lewis, surrounding three sides of the open space on the east of Gower-street, formed a very fine and dignified piece of architecture, one of the best things of its kind in London. To get the laboratories, buildings entirely without any pretence to architecture have been built half across the opening of the quadrangle, a portion of them in two or three stories, the other portion a one-story building, solid, but with no more pretence to architecture than a shed, half obliterating Wilkins's façade and utterly destroying the effect of his building as a whole. There is not even the slightest attempt made to harmonise the new building with the existing one. A more brutal defacement of a fine piece of architecture it would be impossible to imagine than that which the "various distinguished persons" have been invited to inspect, as an example of the way we do these things in England. We hope that among the "distinguished persons" may be some who have a little sense of the claims of art as well as of science, and who may be disposed to speak their mind on the subject.

WE may congratulate Mr. John Burns on the admirable and trenchant criticism which he made, in Committee of Supply last week, in regard to the delay in

completing the South Kensington Museum. The front to Brompton-road, he truly said, was "like a blank factory wall after a fire." What, he continued, was 400,000*l.* to a nation like this? "It was only half the price of an ironclad, to be sunk through a fault in the compass or defective knowledge on the part of her commander." We should hardly accept Mr. Burns as an authority on naval matters; but it is satisfactory to find a member who represents the working classes speaking up so strongly for the adequate completion of a great Art Museum, the present state of which is a disgrace to the nation, and adding that he would gladly support an addition to the vote if it were possible for private members to propose an increase of it. Inasmuch as Mr. Burns is politically allied to the Radical party in the House of Commons, which always endeavours to oppose all expenditure on art, it is the more to his credit that he should have so strongly supported the opposite and more enlightened view of such a subject.

THE current "Quarterly Journal of the Geological Society"* contains a suggestive article on the microscopic structure of Wenlock limestone, by Mr. E. Wethered, which constitutes a distinct advance in our knowledge of the formation of that material. The observations were for the most part made on the stone derived from quarries at May Hill (Gloucestershire); Purley, near West Malvern; and Ledbury. Three classes of limestone were studied:—(1) Massive (2) thin bedded, and (3) nodular and irregularly bedded. After boiling portions of the limestones in hydrochloric acid the results indicated a larger proportion of residue than is usual in most limestones, and as there is evidence that the mineral grains in the original sediment have undergone decomposition, it is clear that the amount of sediment deposited was considerable, so that the structure and composition of the stones have been materially modified during past geological time. It is now ascertained that the remains of crinoids enter largely into the structure of these limestones, shell fragments come next in importance, then valves of a minute crustacean, and lastly brozoa. The organism known as *Girvanella*, which the author had previously shown to be common in many oolitic stones, contributes largely to the formation of some of the beds, and, indeed, oolitic structure has been demonstrated to occur in some Wenlock limestones. The cementing material in the stones under discussion in most instances is calcite—a crystalline form of carbonate of lime. We trust that Mr. Wethered will continue his observations on the structure of limestones, a subject which has hitherto received but little attention at the hands of geologists, but which has considerable bearing on the method of weathering of certain building stones.

IN the *Deutche Bauzeitung*, there is an illustrated article by Herr Ebhardt on "Ancient Rhenish Castles," which deserves the attention of visitors to that part of the Continent. The castles particularly referred to are those of Rheinfels, Turmberg, Katzenellenbogen, Schomberg, and Reichenberg. In most cases the principal walls of the castles alone remain. The design is practically the same in all cases, the site being always on the side of a prominent crag, facing the river, between two valleys, and thus rendered inaccessible from all sides excepting the rear, where protection was afforded by a moat and rampart, the latter in some cases as high as the castle itself. It is noticeable that none of the castles are built on the summit of the crags, but that the principal tower is carried so high as to afford a view over the country lying to the rear. The Castle of Reichenberg is practically the only one that retains any architectural details. It is principally built of slate from the neighbouring quarries, and to judge from its architectural features dates from the twelfth or thirteenth century. Its roof was still on in 1818, when after weathering the storms of war the castle was sold for the value of the materials and a demolition commenced which would have been complete but for the exertions of the late Herr Habel. In the lower part several chambers have now been made habitable, and a collection of ancient weapons and armour is shown in them. The court-yard, a flight higher, is still surrounded by the old massive walls; and to the left of the gateway is the old main building, rising to a height of four or five stories, also still in very fair condition. Herr Ebhardt's interesting article concludes with a strong complaint as to the action of the authorities, who, he says, do absolutely nothing to prevent the complete decay of this valuable historical relic. We know that the Prussian Government spends much money on "restorations" in the most out-of-the-way places. Surely it would pay them to keep a place in repair where there are swarms of tourists ready to pay a toll to see a good example of a Mediæval castle.

* "Quart. Journ. Geol. Soc.," vol. xlix. (1893), pp. 236 *et seq.*

IN *Notes and Queries* of last week a contributor directs attention to the ancient church of Grey Friars, Aberdeen, which it is proposed to demolish for the new front, in Broad-street, of the Marischal University Buildings. He says that whilst the University authorities would preserve the church, the Town Council, who are contributors to the extension scheme, wish for a fresh elevation entirely of granite. It is stated that Grey Friars and portions of East Church (which was partly rebuilt, in 1834, on the St. Nicholas site) form the only remaining pre-Reformation buildings in the city. Grey Friars, formerly called the College Church, was built in the interval, 1518-32, by Bishop Dunbar, the architect being Alexander Galloway, rector of Kinkell. Enlarged last century, it is now almost surrounded by later structures.

WE have received an illustration, as also the block from which it was printed, of the ceremonial key with which the Queen unlocked the Imperial Institute on the opening day. The design is considerably better than some similar things that have been sent to us, but it shows nothing to justify its publication in our pages. We shall be only too glad to publish the designs of ceremonial keys and other objects of the same class when we receive anything which is really the design of an artist; and that is little likely to be as long as the name of the real designer and artificer of such objects is kept hidden behind the frontispiece of a trading firm. Give an artificer the chance of distinguishing himself as an artist and getting credit for his work, and he may do something really good; at all events he will be more ambitious to do so and more likely to try than when it is merely a question of satisfying an employer and getting his wages and no credit beyond. Or if a firm do not like giving an artisan this chance, why do they not at least go, on such an occasion, to a known artist and get a design from him? They might then send us something worth publishing. As it is, all we can say of the Imperial Institute key is that we have seen a good many worse ones, with which negative praise its projectors must be content, as far as we are concerned.

IN these days of competitive examination we feel disposed to suggest one more application of this test of fitness—viz., an examination of applicants for admission into picture exhibitions, to show that they have sufficient understanding of the meaning and objects of painting to have a reasonable claim for admission. A few days ago the writer stood before a painting at the Royal Academy which has impressed every competent person with its new and original power in the treatment of one aspect of nature, and heard nothing from the passers-by but a continuous succession of sneers and exclamations of bewilderment and disgust: "Did you ever see such a thing?" "Just look at that thing!" "Whatever do they hang such a picture for?" &c., &c. What are such people let into an exhibition for, to take up room and swallow up the oxygen from those who can make a better use of their opportunities? Of course it must be admitted that, from the financial standpoint, the receipts of the Royal Academy would be seriously diminished by their exclusion; and worse, it might be suggested that some Academicians who have the privilege of putting their pictures on the line know as little of the ends for which painting was ordained as any of the visitors.

ARCHITECTURE AT THE ROYAL ACADEMY.—IV.

1,548: "Staircase Window"; Mr. Medland Taylor. This is a very good window design, consisting of a three-light window with figures of "Painting," "Poetry," and "Sculpture," treated in low tones, with very well designed drapery. The figure subjects are cut off at a level line at the foot, but the ascending stairline is followed by the predella panels beneath the figure subjects. What there is of positive colour in the window is to be found in the background to the heads and in the lower panels. The figure of Poetry, in the centre light, is represented with one foot on a step, as if ascending stairs, a pretty reference to the position of the window. Altogether this is a bit of stained glass which rises above the average in design and idea.

1,549: "Villa;" Messrs. Ernest George and Peto. From the plan and sketches this appears to be a villa for some exalted personage, to be erected in a hot climate. The plan shows a state reception room, "his highness' private room," &c.; the most noteworthy point in the planning being the separation of the kitchen wing entirely from the house by an open covered gallery, and the position of the dining-room as an open arcaded pavilion reached by a short corridor branching out from the before-named one, midway between the villa and the kitchen block. The pavilion is open all round, with timber supports and arch-like openings formed between them. The gables are decorated with geometrical half-timber work, rather English in appearance, for a house which is obviously not to be on English soil.

1,551, 1,557: "Design for a Country House"; Mr. Gerald C. Horsley. These are two elevations in ink line, on a rather large scale for this sort of thing (four feet to an inch), showing the entrance and garden fronts of a country house with little architectural pretension, with rather wide low windows with wooden mullions and small square panes. The mass of roof looks too heavy for the rest and crushes it rather. A plan is appended, showing an entrance vestibule divided by a screen from the hall proper, which is practically a sitting-room communicating with the dining-room on one side and the drawing-room on the other. The exterior walls are decorated with subjects referring to country life, a man mowing, another sowing, &c.; they are merely indicated in line, and are probably meant to be executed in *sgraffito*. The subjects on the gables on the entrance side are apparently ideal, and represent a crowd of figures under conventionally treated trees; to that we have no objection; but the painting of somewhat realistic figures carrying on realistic country occupations, as an exterior decoration to a country house, is somewhat too much akin to Pope's attempt to be "rural" by having rakes and scythes painted as leaning against the walls of his villa. Why paint them on the house when you have the real people going about around you? In any case, the decorative effect of such a treatment can only be judged of in a coloured elevation. By the same author are

1,552, 1,556: "Design for the painted decoration of the roof of a University Hall" (the catalogue gives "*an* University Hall," which is bad English); No. 1,556 giving part of the design to a larger scale. This is a peculiar design, of considerable originality. The lower part of the dome is treated as a kind of decorative base for the rest of the design; the space is divided off by an arcade of pointed-arch compartments painted on the wall,

filled in with gold arabesques; the spandrels between them have medallions with symbolical heads, on a dark blue ground partially broken by a design. Above this the dome surface is divided into rectangular panels (rectangular except for the necessary diminution upwards) by rigid bars of green foliage, and in each compartment stands a symbolical draped figure on a sphere, and backed by a continuous battlemented wall over which is a wide horizontal band of greenery in the similitude of a hedge. Over this some boundary lines and the empty central space of the dome, which may do for a window. At the feet of the figures appears to circle a river, represented by a band of blue. The figures are not very effective, and in one case the artist seems to have been uncertain how he would treat the hands, and the figure has three hands; at least that is all we can make of it; but the whole is an original idea and would have a good decorative effect. The kind of ribbon which meanders round in the open sky space above what we have called the "hedge" is a puzzle, unless it is a very conventional indication of a fountain.

1,553: Apse windows, "Hillhead Established Church, Glasgow"; Messrs. Shrigley & Hunt. A couple of lancet windows, showing some individuality of treatment. The figure subjects occupy two stages in the design, separated by, or rather imposed upon, an ornamental design of interlacing lines of somewhat Celtic character; the canopy decoration above the lower subject ("Christ Before Pilate"), consisting of dark scroll stalks with yellow leaves and dark flowers springing from them, is effective. The general colour effect of the whole is good.

1,554: "Design for Wrought-iron Grille for quarter-domes, St. Paul's Cathedral"; Mr. A. H. Skipworth. We presume this is intended to fill the spaces under the arches in the angle piers under the dome. We do not quite see why they should be filled with a grille, but the design is good and in the true spirit of classic wrought-iron work. We should have liked it still better, however, if the designer had avoided the vertical lines cutting into the arch, which is no doubt a constant feature in the treatment of large arched windows and openings in English Renaissance work, but is none the better on that account; the vertical lines cut awkwardly into the arch line. It would have been better to have allowed the arch form to rule the whole lines of the design.

1,558: "St. Peter's College, Radley, new Cloister and proposed new Chapel and Hall"; and 1,562: "New Cloisters and proposed new Chapel" for the same place, seen from another point of view. The latter drawing has been published in the *Builder*; it shows the chapel and cloisters only: the new drawing, a slight and apparently hurried one, shows the chapel from the other end, and the hall, and cloisters connecting them. The chapel and hall form nearly symmetrical blocks, both with the same general outline but treated with sufficient distinction of detail, the style being late Gothic of what is commonly called collegiate type, with low-pitched roofs and raking battlements up the gables. The west end of the chapel, shown in No. 1562, is very effectively treated, upper and lower windows and wall-panelling being all combined into one design bounded at the sides by two small buttressess which run from the ground to gable; there is an octagonal turret at this end, with a lantern the details of which look too thin and cast-iron in style; there is plenty of precedent for this thin treatment, but it hardly becomes better for that, except as a mere matter of archæological sentiment. The one point we really do not like in the design is the introduction, above the window arch at the ends of the chapel, of wall-tracery on quite a different scale from the tracery of the window below, which has an awkward and confusing effect.

1,561: "South-Eastern Hotel, Deal"; Messrs. James Brooks & Son. No plan. The building, shown in a large clearly executed pen-drawing, makes an effective block, and has the merit (for under present circumstances it is one) of not looking so terribly like a hotel as most hotels of the day do; whereby we mean to suggest that while in general it seems an understood thing that hotel architecture should exhibit a flashiness of style, and absence of all refinement or restraint in detail, and an exuberance of balconies and wrought-iron roof-ridges, this example is free from such characteristics. The most salient features in the design are the angle pavilions set obliquely at an angle of 45 deg., and flanked by solid octagonal turrets with lead cappings or little cupolas, which support the base of the gable. A less pronounced gabled projection forms the centre of the main front, and marks the principal entrance. The principal windows, which are round-headed on the ground and first floors, and square-headed and mullioned on the upper floor, are exceedingly well grouped and combined by means of the minor architectural features, to which they have direct relation, so that there is an architectural unity about the whole; it looks like a hotel, but a hotel much more carefully designed than usual.

1,566: "Balliol College, Oxford; new house for a tutor on the College grounds, Holywell"; Mr. T. G. Jackson, A.R.A. Two Indian-ink sketches in one frame, showing a house in a solid domestic Gothic style, save that the gables are Elizabethan in character, and exhibit some delicate variations of detail. Two semi-circular bays, running through two stones, are prominent features. We fail to see the use of the buttress flanking one of the gables, it does not seem to be wanted there more than anywhere else for support of the walls. A plan would have explained the meaning of the little one-storied addition in the re-entering angle on the lower drawing, for which there is no doubt a reason, not apparent in the exterior design.

1,567: "Chapel, Selwyn College, Cambridge"; Sir A. W. Blomfield, A.R.A. This was illustrated in the *Builder* of May 13, to which we refer the reader in place of any description. The building is an excellent piece of modern Gothic, following faithfully the traditions of college chapel architecture. By combining the actual west window with a blank tracery design, of which it forms part, and which occupies nearly the whole wall between the angle turrets, the architect has given an increased breadth and dignity to the front without rendering the window too large from the interior. The value of plain wall space is well illustrated in the plain treatment of the lower portion of the turrets, and the bay next to them.

1,569: "The Chapter-house of a Cathedral"; Mr. John Begg. A perspective view of this design was published in the *Builder* for April 16, 1892. This is a coloured elevation, showing a chapter-house designed on a hexagon plan, a brick building with stone dressings. The principal windows are arched with three-centred arches, the mouldings of which partially die into the face of the buttresses; the spandrel space between the labels and the main cornice is occupied by tracery and carving- The design would have gained by a little more simplicity; there is too much wall over the main cornice, and there are no less than three ranges of small openings besides the main windows; a set of slits opening into the roof (apparently); a range of small square-headed windows just below the sill of the main ones, lighting an ambulatory, and below them again a range of slits lighting presumably a crypt. The importance and effect of the principal architectural features is a little interfered with by all this work above and below them, especially by the mass of blank wall above. There is a great deal of merit in the design, however, which was placed second for the Soane Medallion last year, and can hardly be said to be inferior to the one which was selected.

1,570; "New Banking Premises, Parliament-street"; Mr. H. Huntly Gordon. No plan; a spirited drawing lightly tinted in Indian ink, and owing a good deal in general treatment to Mr. Norman Shaw's building at the bottom of St. James's-street, especially as to the treatment of the large ground floor window. The windows are picturesquely grouped and the features of architectural ornament in good taste, the chimneys well treated in a simple manner, and the whole is a very agreeable example of the modern picturesque street front. The author would have done better to omit the badly-sketched figure which forms the finial on the highest point of the roof.

1,571: "Alterations, Itton Court, Monmouthshire"; Mr. E. Guy Dawber. This was illustrated in our last issue. The new portions are in keeping with the character of an old house, the dates of which vary from the fourteenth century to the middle of the eighteenth; but the end of the new "hall," a long narrow building the end of which abuts on the courtyard, might have been better accentuated in the courtyard elevation. In justice to the original drawings, we may observe that the shadow in the foreground appears much stronger and blacker in our illustration than it really does in the drawing; one of the inherent defects of photo-lithography, in which lines which are fainter in the original come out as dark as all the others in the copy; a defect which cannot be helped. The only way to get a fainter effect in photography from a line-drawing is to use thinner lines; it cannot be done by using fainter ink; a fact of which many draughtsmen are still ignorant.

1,572: "Public Library, Colchester"; Mr. Brightwen Binyon. This is a pleasant and original little building, of red brick and of Jacobean leanings; the main feature is the large window which lights the principal room, and which forms an architectural design in itself with cornice and supporting figures in the upper portion; the horizontal cornice cuts across the middle of the gable over, leaving three triangular spaces which are filled with modelled ornament in plaster. The design of this window ought, however, to have had a more architectural base than is supplied by the set-off in the wall and the very plain basement windows, which are an eye-sore in this position. A plan is added.

1,573: "St. Pancras Municipal Buildings; first premiated design"; Mr. W. Harrison. To this we already briefly referred in the course of a few remarks on the designs submitted in this competition (page 81 *ante*). It is better than some recent Vestry Halls, in being less pretentious in style, and the architect's choice in placing the council chamber and committee rooms on the second floor, at the top of the building, has left open to him an effective arrangement of large mullioned windows just at the top of the elevation under the cornice, the lower portions of the wall being left comparatively solid; this looks well, though we cannot think that putting the principal rooms so high up can be convenient. There is a certain character given by the circular turrets which flank the principal front, and which we presume are staircases, but no plan is given.

1,574: "A Cheshire House"; Mr. John Clarke. Why "Cheshire"? There is nothing especially Cheshire about it; half-timber houses are common enough in several other counties. This, like "a Doctor's House" before alluded to, seems a bid for a taking title. The house is an adequate one of its kind, but the pen-drawing (*e.g.* the grass) rather mechanical.

1,575: "New Royal Infirmary, Derby"; Messrs. Young and Hall. We only mention this because it is a good specimen of a clear pen-drawing, not over-worked, and with plenty of atmosphere left in it; but it is merely a picture of an infirmary, perfectly useless without a plan, and presenting no architectural features which are of any interest as such.

1,577: "St Mary's Hospital, Paddington; perspective view of design for Clarence Memorial Wing"; Messrs. Salter & Adams. A small plan is appended to this, which is a large and carefully elaborated pen-drawing, showing a not unsuccessful attempt to give some architectural interest to a hospital building. The end pavilions are treated very plainly in the two lower stories, with rusticated walls, and the walls oversail to some extent above the principal stringcourse, the oversailing being the more remarked as the pavilions are treated with octagonal angle turrets, which are consequently considerably thicker above than below. There seems no reason for this treatment beyond the desire to produce a certain degree of picturesque effect. The upper portion of the building is decorated with pilasters, and the central portions, between the wings, get light and shadow from two tiers of wide balconies, carried on large and solid cantilevers. The first floor windows in this central portion have sculpture decoration in square panels over them. The plan shows that the central projection of the front does not answer to the centre of the plan, and that on one side we have a complete ward, on the other side a ward with a passage taken off it. The front does not seem to coincide with the plan in this point.

1,579: 1,580: "Glangwna, Carnarvon"; Messrs. Douglas & Fordham. These two drawings were published in the *Builder* of March 11 of this year. They represent a pretty large mansion, consisting of half-timber work above, based on solid stone wall in the ground story. The house looks very well in the excellent tinted drawings in which it is shown, but does not present any very marked character to distinguish it from other houses of the same style and of the same scale; it is all very satisfactorily carried out.

1,581: "St. Peter's, Pentre, Glamorganshire"; Mr. F. R. Kempson. We published another view of this church some little time since (*Builder*, October 24, 1891). It rather errs on the side of too conscientious solidity and despising of all mere prettiness: plain masses of wall, windows without tracery, and a square battlemented tower. Economy has perhaps been at the root of this; and it may at any rate be urged that heaviness is a better fault than trickery.

1,583: "Front entrance to Ashby Folville

Manor, Leicestershire"; Mr. John Ely. Is this old or new work? We presume new, or a new addition to an old house. It is a very well executed sepia drawing, showing the entrance porch of a Renaissance house with coupled wall columns on each side of the doorway, and a single half-column on each side above, treated not quite like an ordinary order. The porch is crowned with orthodox forms of Renaissance finial. On each side are large mullioned windows, forming a screen abutting against the two wings of the house. The balustrade over these is too widely spaced, and looks rather mean in consequence. The projecting oriel over the entrance is rather heavy, and on the whole the drawing strikes us as better than the design.

INCORPORATED ASSOCIATION OF MUNICIPAL AND COUNTY ENGINEERS:

MEETING IN DERBYSHIRE.

A MIDLAND COUNTIES' district meeting of this Association was held on Saturday, the 20th inst., for the purpose of visiting and inspecting the new waterworks of the Long Eaton Local Board at Stanton-by-Bridge, near Derby. The works, which have been constructed from the designs of Mr. George Hodson. M.Inst.C.E., F.G.S., of Loughborough, are intended to supply the district of the Long Eaton Local Board, and the towns of Melbourne (Derbyshire) and Castle Donington (Leicestershire).

The members assembled at the Midland Hotel, Derby, and drove in breaks to Stanton-by-Bridge. On arrival at the waterworks, the members, under the guidance of Mr. G. Hodson, the engineer, and his assistants, went over the pumping-station, and inspected the powerful engines and pumps which have been erected by Messrs. Tangye, of Birmingham. After the inspection of the works the members were entertained to luncheon by Mr. Hodson in a marquee specially erected in the grounds. Mr. Hodson presided, and amongst those present were Messrs. J. Cartwright (Bury), President of the Association, A. T. Davis (Shrewsbury), Hon. Secretary for the Midland District, E. Pritchard (Birmingham), J. Clare (Sleaford), W. Santo Crimp (London), J. Sheldon (Long Eaton), R. Godfrey (King's Norton), A. R. Ridout (Wirksworth), W. Weaver (Kensington), J. H. Radford (Putney), R. R. Hooley (Nottingham), R. Whitbread (Carlton-in-the-Willows), H. James Rinford (Ilkeston), G. W. Hawley (Nottingham), G. H. Lilley and J. W. Metcalf (Ashby-de-la-Zouch), J. S. Pickering (Nuneaton), J. T. Hawkins (Somerton), J. Myatt (Leek), S. Stallard (Maidstone R. S. A.), F. Massie (Wakefield), W. Hampson (Leicester), C. S. M. Wilson (Bilston), J. Gammage (Dudley), and a number of members of the Long Eaton Local Board and other visitors. Upon the conclusion of the luncheon,

The President (Mr. Cartwright) called upon Mr. Pritchard to propose a vote of thanks to Mr. Hodson for his hospitality. He had known Mr. Hodson himself for a long term of years, and had heard and seen something of the good work which Mr. Hodson had carried out as an engineer in different parts of the country.

Mr. Pritchard (Birmingham) said he had special pleasure in doing this, as he had been personally acquainted and professionally engaged with Mr. Hodson for more than twenty years. As the professional adviser of the town of Loughborough Mr. Hodson had so far succeeded in satisfying the ratepayers by his engineering work as to warrant them in electing him a member of the Local Board, and afterwards to the chief position in that town. That said a great deal, but what had been done for Loughborough had been done by Mr. Hodson for many other districts in the designing of works which had been greatly to the advantage and interest of the Boards by which he had been employed. They knew him also as a London engineer, and they appreciated him and approved his work as highly in Westminster as they did in the country. It might not be inopportune to mention that the Association of Municipal Engineers, which had done so much to elevate the professional status of the municipal engineer all over the country, and contributed in no small degree to the health and convenience of the public, was very strongly supported in its earlier days by Mr. Hodson.

The toast having been heartily honoured,

Mr. Hodson, in responding, said the test of the engineer was the result of his work. At present they had only seen the work, but he hoped to show a financial result in a few years which would make the Long Eaton Local Board thankful for having undertaken those works. Water companies expected to make a profit of 10 per cent., and, as Local Boards could borrow money for 3½ per cent., there was a wide margin for making a handsome profit. Taking the interest at 3½ per cent., and sinking fund 1½ per cent., there ought to be a profit of 5 per cent. The Local Board ought to look at waterworks from a commercial point of view, as they did at gas or the electric light. If the business was only managed on these lines, and party politics kept out, a Local Board could manage as well and efficiently as a board of directors. In conclusion, he thanked the members of the Local Board for the generous confidence they had shown in him throughout the construction of the works; and as a result the contract had been completed without exceeding the amount of the original estimate.

Underground Water Supplies.

Mr. Hodson, jun., son of the author, then read a long and interesting paper, written by Mr. George Hodson, C.E., entitled "A Consideration of Some of the Conditions Requisite for Obtaining Underground Water Supplies," illustrated by a description of the works for supplying Long Eaton and Melbourne (Derbyshire), and Castle Donington (Leicestershire). After some prefatory remarks, the author said that the success or otherwise of schemes of water supply depends principally upon the correct appreciation of natural conditions, and he gave a short outline of the theory of water supply, and the physical and geological conditions essential for obtaining water in large quantities and of proper quality for the supply of a town population. All the sources of fresh water supply have but one common origin, namely, the rain or snow falling from the clouds; and the ultimate destination of all rainfall may be classed under two heads; the proportion evaporated and returned to the clouds as an invisible vapour, and the proportion returned by the streams to the ocean. This latter may be again subdivided into the proportion flowing off the surface during periods of heavy fall, which constitutes floods, and the proportion absorbed and temporarily retained in the strata, which is gradually returned to the streams by springs, either thrown out on the surface, or occurring in the river beds, which constitute the flow of streams during the absence of rain. In clayey districts and in districts of primary rocks, the ground is impervious, and a large percentage of the rainfall is returned with great rapidity to the sea; but in districts composed of porous rocks, sands, and chalk, a considerable proportion of the rain is absorbed into the ground, through which it slowly filters, and the period occupied in its return to the sea is dependent upon the porosity of the strata, the head due to the difference of vertical level of the area of absorption and the area of discharge, and the distance through which it has to pass. Supposing no more rain were to fall upon a porous area of outcrop, all the absorbed water would eventually run out, and the springs and streams would become dry; but so long as successive rainfalls keep adding to the underground water before the point of exhaustion of the springs is reached, they continue to flow, and the quantity they discharge is dependent upon the conditions before enumerated. Below the level of the lowest spring in a porous district a store of water must of necessity remain in the interstices of the strata, forming an underground reservoir, and below low water mark the originally absorbed water has remained at rest since the sea assumed its present level. When a well is sunk into an underground reservoir and pumping is commenced, the outflow from the springs is at once diminished to the extent of the quantity pumped, and if the pumping is in excess of the rainfall absorbed, the springs are successively dried up and the ancient store of water in the strata is eventually pumped out, and afterwards no more water can be pumped than each successive rainful supplies to it. The measure of the permanent yield of any well is therefore exactly proportionate to the area and capability of absorption of the watershed contributing to it, in precisely the same manner as the measure of the capacity of the yield of an impounding reservoir depends upon the area of the gathering ground upon which the rain falls, the amount of rain, and the proportion of it which can be stored. In each case, during a period of drought the water level in the reservoir may be lowered and space provided for the accumulation of another store during the next wet period, but in each case it is evident that it is a hopeless matter to expect to obtain a permanent supply of a fixed quantity of water unless the proportion of the rain falling upon the contributing area which can be collected by either method is equal to the quantity which it is desired to abstract. In the case of an underground supply it is not necessary that the absorbing area should be in the immediate vicinity of the well, provided that the pervious strata is continuous from the well to the absorbing area, and numerous proved cases exist where in fact they are many miles apart. In districts where the absorbing area occupies higher levels, and the strata composing it descends under an impervious formation having no outlet into the sea, the interstices of the strata become filled with water up to the lowest lip of the impervious stratum (which may be at a considerable height above the low-lying ground), and the perennial rainfall flows out at a spring at this point. If a well is dug or a bore-hole carried through the watertight stratum which covers up the saturated rocks or sands, the water will rise up to the level of the lowest outflow or natural spring, and thus constitute what is known as an artesian supply. Immediately the new outlet is made, exactly the same laws apply to the artesian reservoir as to the cases previously described, and this is proved by the well-known instance of the artesian wells in the chalk under London, where, formerly, the water rose above the surface in all the lower grounds of the valley of the Thames, but the multiplication of artesian wells has caused so large a drain upon the underground water that the inflow of the rain waters from the outcrop cannot keep pace with the quantity removed by pumping, and consequently the line of water-level has been gradually lowered until it now stands under London about 100 ft. below the Thames, and in course of time the ancient stock will be exhausted and the yield will become limited to the amount of the perennial rainfall.

In addition to the foregoing considerations as to yield; if the supply is to remain pure it is of vital importance that no part of the porous watershed contributing the supply shall be occupied by a dense population, because wherever this is the case, sooner or later, dependent upon the nature of the strata, pollution will certainly ensue, and the water of even deep wells will be affected. It was entirely due to pollutions on the surface of their watersheds that several of the old pumping stations of the Liverpool Corporation have been successively abandoned, and many other towns have suffered from the same cause. In the author's practice it has become his duty to condemn several old waterworks where the pumping pull had drawn to the well impurities, which, until the artificial conditions set up by the pumping operations were established, passed harmlessly away in an entirely different direction. This was notably the case at Pontefract, where the old sewers were simply excavations cut into the porous rock, and cesspools or dumb-wells in the higher parts of the town received the discharges from the water closets, but they retained so little of the solid matter as not to require emptying for years together. In this case the rock formed an exceptionally high-class filtering medium, but in the course of time it became so highly charged with the oxidised animal refuse that although no distinct case of epidemic disease could be traced to the water supplied from the well, every analyst who was consulted upon the question condemned its further use in strong terms.

The Rivers Pollution Commissioners in the conclusions of their valuable report, class "deep-well water" as the second best source of supply. It therefore follows that wherever the conditions essential for obtaining an underground supply within a reasonable distance are available, no effort should be spared to secure it.

To secure the conditions essential for obtaining a permanent underground water supply, it is frequently necessary to proceed many miles away from the town to be supplied, and in some instances very great stress is laid upon this fact by the opponents who invariably crop up whenever any scheme for obtaining a public water supply is propounded. In reality, in nine cases out of ten, the additional cost is confined to the additional length of main pipe, and the cost of overcoming the friction of the water through it, and in some cases is even less than this, because of the simpler methods which can be adopted for obtaining the water at the distant site. Most certainly the nearest available site, when quantity, quality, and other conditions are equal, should, as a matter of course, be taken; but too much stress must never be placed upon the mere question of distance to the source, whether that source is surface or subterranean, because, after all, the cost of a mile or two, or even a few miles of pipes, sinks into insignificance when the quality, copiousness, per-

manence, and prospective freedom from pollution are in favour of the one more distant.

In seeking for an underground water supply the position of the engineer is one of much greater anxiety than when his quest is for a satisfactory gravitation scheme. In the one case his source and its watershed are apparent, and he can gauge the quantity flowing off day by day, and year by year, and the analyses of samples dipped from the stream settled the question of quality. Mr. Symons has acquired for himself such elaborate information as to the rainfall over long periods of years, that very simple calculations enable him to arrive at sound conclusions in respect to the amount of storage which must be provided to utilise the watershed to its fullest capacity, and the difficulties of the engineer are in a great measure confined to the selection of a suitable site for a reservoir, and its safe construction, and in this matter so many excellent examples exist throughout the country, particularly in the Northern districts, that a capable engineer may quickly master the principles of successful work.

With underground sources the question is much more complicated. We have first to catch our hare; and few who have had much experience of underground water will be inclined to be over sanguine as to ultimate success, until the most careful geological examination has been made over every portion of the district from which it is anticipated that the supply will be derived, and until by means of boring and every other possible precaution, its freedom from faults and other interruptions has been ascertained. The engineer must satisfy himself as to the quality and extent of his absorbing area, and use the judgment which experience alone can give as to what percentage will percolate into it, and in deciding this question not only the characteristics of the different geological formations have to be considered, but also the nature of the soil—the surface slopes—and the facilities which exist for carrying the rainfall back again to the sea. He must carefully note the levels of the various springs, not only to ascertain that his underground sheet of water is continuous, but also to ascertain the direction in which the waters travel, so that he may arrive at reasonable certainty that the position of his proposed well will command it. He must adopt means of calculating the annual available percolation, and take care that he has a sufficient balance over the visible supply to ensure a perennial yield of the quantity required for his purpose. An examination of the banks of the streams will show at a glance, by the past action of the water upon them, whether the rainfall passes off in rapid floods; or, on the contrary, the absence of violent action on the banks will indicate that the return of the rainfall to the sea is spread over many months of the year, thereby proving that the underground store is of large extent, and that the absorbed rainfall is retained over considerable periods. He must also bear in mind that there is no law conferring a right of property in underground water, and that he must therefore place his works so that no one can come after him and choose a site from which his works may be dried up, so that if rivals do come into his watershed he must have secured the lowest position in reference to the gravitation of the underground water, so that he will have the pull of the water from his neighbour, if the circumstances happen to be such that there is not sufficient for both. In addition to these considerations he must, in choosing a site, guard himself as far as can possibly be foreseen, against the pollution of his watershed by the growth of the population, or the extension of industries, which may occasion such pollution as will necessitate the abandonment of the works.

By such means, and by the use of a series of empirical rules based upon personal observations, which it would be difficult to give precisely in a written paper, and which could only be effectively conveyed by explanations given on the grounds of watersheds upon different geological strata where the system has been applied, it is possible to discover within very near limits, not only the direction of the underground flow, but also the annual available yield which can be looked for permanently, and the most favourable points for its abstraction.

Mixed up intimately with this all-important matter of the watershed examination is the question of main barrier and minor faults, anticlinal and synclinal folds, and other irregularities of the strata which break up the underground water planes, and bring disaster if their effect is not duly appreciated. Their discovery is often a most trying but interesting work, and their effect upon the question to be solved constitutes probably the greatest difficulty in connexion with water supplies from subterranean sources. The surface investigations of a watershed usually give indications to a skilful geologist of their existence, but it is almost impossible to appreciate their actual effects unless the investigator has had some considerable experience of mining operations. The maps published by the Geological Survey indicate the actual position and throw of faults where they have been proved by mining operations, and in other districts where they dislocate a sub-division or an entire formation to a sufficient extent to be apparent on the surface, or where they bring one distinct portion of a formation down against another; but it is needless to say that the inch scale map shows nothing but the palpable dislocations, and the engineer must rely upon his own observations for detecting and guarding against the interruptions caused by the numerous minor faults with which the Geological Survey does not deal. Besides this, the engineer must not place a child-like faith in the maps of the Survey; many of them were made years ago, and require serious revision, and any one retained for, and upon whom the responsibility rests of recommending the outlay of the large sums of money required for the construction of waterworks, ought not to regard the maps as showing anything more than the approximate boundaries of the principal geological formations, and the major faults. When a re-survey has been made and plotted, say upon the 6 in. map, the department will be able to descend from general to precise information, and the work of the engineer will be facilitated; but after all, if his works are to be successful, he must intimately study the district, and by the preparation of sections of the strata in every doubtful direction, and by the free use of the boring tool, discover for himself the actual existence of all the conditions essential for success.

Thirty years ago Long Eaton, with the exception of Messrs. Claye's Railway Waggon Works, might be fairly considered an agricultural village, but owing to certain natural advantages, it has become gradually one of the chief centres of the Nottinghamshire lace industry. Its population is now about 10,000 persons, and the rapidity of its growth may be judged by the fact that its increase during the last decade was no less than 55 per cent. The town is built upon a bed of sand and gravel drift brought down by the rivers Trent and Derwent in past ages. This drift rests upon the Red Marl of the Trias, and varies in thickness according to the undulations of the Marl beneath it.

As in all other new districts, the first growth of the town was unaccompanied by those works of sanitation which are an absolute necessity wherever human beings congregate together, and the Local Authority was not formed until the nuisances due to the lack of sanitation had become intolerable. The sewage was freely emptied into the waterlogged subsoil upon which the town is built, and as the occupied area became larger, so much more did the pollution of the well water increase, until it is doubtful whether any of the wells, except those in the very outer ring of the built-upon area, yielded water fit for domestic consumption. The Local Board, when formed, proceeded at once to deal with the sewage question, and have solved it in what may fairly be considered a satisfactory manner. In consequence of the reports of the Medical Officer of Health, their own observations, and the representations of the Local Government Board, the question of the water supply had formed the subject of many discussions, and was postponed from time to time from financial reasons only.

In November, 1888, the matter was brought to a crisis by the publication of the preliminary notices of a company called "The Long Eaton and District Water Company," who, without in any way consulting the Local Board, proposed to secure the monopoly of the water supply of the district by including it in their limits of supply, and the author was retained by the Board to examine the company's scheme and report thereon. Having investigated the company's proposals, he formed the opinion that none of the conditions essential for success were present, and that the scheme propounded would certainly fail; and at a subsequent interview with the Board he was instructed to investigate the district and propound a scheme which the Board could properly submit to the Local Government Board. For this purpose a careful physical and geological examination was made over the district, extending from Little-Eaton on the north-east, from whence Derby derives its supply, to Nottingham on the north west, and from the escarpment of the Lias on the east to the Millstone Grit district around Melbourne on the south-west, comprising an area of upwards of 120 square miles. This area is bounded on the north by a main fault, which, so far as is at present known, forms the southern termination of the Derbyshire Coalfield, and is nearly wholly composed of the Red Marl formation, which, sweeping around from Cheshire and Staffordshire, extends down the valley of the Trent nearly to its junction with the Humber, the deep river valleys of the Trent, Derwent and Soar being cut down by erosion out of the solid formation, and filled in in the river valleys with drift gravel brought down from the higher grounds.

For many miles around Long Eaton the Red Marl is permeated with striated bands of gypsum, and at Chellaston, Thrumpton, Gotham, and East Leake the mineral is extensively worked, and forms one of the most valuable natural products of the district. The formation is an impervious one, and would be entirely barren of water but for the few thin bands of impure sandstone and gypsum which subdivide the mass of the Marl. Some of these bands have an outcrop on the sloping hill sides, and imbibe a moderate quantity of rainfall, but the water traversing them takes up so much of the mineral matter as in some cases to be utterly unfit for use.

The rivers Trent, Erewash, Derwent, and Soar, all of which join in the vicinity of Long Eaton, and any of which would in a new country form the natural supply for Long Eaton, were hopelessly out of the question for obtaining a supply of potable water. The Trent receives the sewage of Birmingham, Burton-on-Trent, and most of the Black Country, as well as that of the North Staffordshire Pottery district; the Derwent receives the whole volume of the untreated sewage of Derby; the Soar is the receptacle of the sewage of Leicester and Loughborough, as well as Melton Mowbray and several important villages on its banks, and although since these waterworks were commenced the Corporation of Leicester have carried out extensive works of sewage treatment, the condition of the river is still such that no one would dream of taking water for domestic consumption from it; and the Erewash at present forms the common sewer for all the mining population within its watershed, and although it may be said of the surroundings of Long Eaton that there is "water, water, everywhere," it is literally true that there is "not a drop to drink."

From the causes previously enumerated, which pertain to shallow wells everywhere, the gravel water under the town was probably as badly polluted as any of the rivers; and besides this, owing to the erosive action of the Trent whilst forming the plateau of gravel on which Long Eaton is built, it is evident that an underground ridge of Marl exists in a direction more or less parallel to the River Derwent, which arrests the percolation through the river gravels from that direction under Long Eaton, whilst the rainfall has a free outlet on the south side into the Trent. This erosive action has formed terraces of gravel at successive levels, and although the rain water is held up whenever the rivers are in flood, immediately the floods subside the underground water is rapidly passed off again.

The volume of water which can be obtained from any one well is therefore limited, and if it were attempted to supply the town by pumping from the gravel the works would certainly fail during a prolonged period of drought.

Although the district lying between Derby and Long Eaton is valueless as a source of underground water, it was thoroughly investigated to ascertain whether any suitable localities existed for impounding surface water. None of the streams were of sufficient height to allow of a gravitating supply; and in any case, if the water was impounded in a reservoir it would then have to be pumped to the higher ground for distribution, and to afford protection against fire. The watersheds throughout the area are very small in extent, and where the streams attain any considerable length and drain a fairly large district, they usually pass through one or more villages, and are made to act as the carriers of sewage.

The result of these investigations made it apparent that surface supplies were entirely out of the question, and that underground supplies to the north-west and north-east were unobtainable, and that the only hopeful direction would be the areas of Keuper Sandstone or Millstone Grit lying to the south-east.

Ultimately, after various experimental boreholes had been made, at Weston-upon-Trent and elsewhere, the works just completed for the supply of Long Eaton, Melbourne, and Castle Donington, were taken in hand, the sum of 44,768*l.*

being borrowed for the purpose, viz., 39,768*l.* for Long Eaton, 3,000*l.* for Melbourne, and 2,000*l.* for Castle Donington. Messrs. Price & Shardlow took the contract for Long Eaton at 33,954*l.*, and the supply provided is at the rate of twenty gallons per head of population per day. The pumps and engines were supplied by Messrs. Tangyes, Limited, and the air-valves, &c., by Messrs. Blakeborough & Sons. Mr. Hodson gave a detailed description of the works, which will be printed in the *Proceedings* of the Association.

Mr. A. T. Davis (Shrewsbury), in proposing a vote of thanks to Mr. Hodson for his paper, said he was sure the members of the Association would feel deeply grateful to Mr. Hodson for giving them the results of his great experience in waterworks engineering. The paper was a most exhaustive one, and would add greatly to their knowledge.

Mr. Thorburn (Birkenhead), who seconded the vote of thanks, said that Mr. Hodson had provided a water supply admirably adapted to a district like Long Eaton. The paper was so elaborate as to require very careful consideration, but speaking offhand, and from a cursory glance at it, he considered it most carefully explained the circumstances of the district, and the successful accomplishment of the provision of an underground supply.

Mr. Pritchard (Birmingham) said he thought the district was to be congratulated for not having allowed a company to look for water where there was no water to be found; and the people of the district ought to be thankful to the Long Eaton Local Board for having taken the matter into their own hands, and obtained the professional services of Mr. Hodson to provide them with a water supply. He begged personally to thank Mr. Hodson for the very able paper he had submitted to them.

The Vice-Chairman of the Long Eaton Local Board said that from the moment they called in Mr. Hodson to the completion of the works, he could not remember an instance in which fault had been found with him. It was only due to Mr. Hodson to say that the Board were perfectly satisfied with the scheme, and that he had justified their confidence. Although their mains passed through the territory of three other urban authorities, and two counties, Mr. Hodson had, by his ability and ingenuity, completed the scheme without litigation. In years to come Long Eaton and the districts supplied with water would have cause to be grateful for the work undertaken by the Board with the assistance of Mr. Hodson.

Mr. W. Santo Crimp (London) said the paper was an exceedingly interesting and valuable one, and he was sure would become a classic on underground water supply. The paper showed the immense value of a knowledge of geology when dealing with works of this kind. They were in a valley in which there was no indication of water on the surface, but Mr. Hodson brought his geological knowledge to bear, and he was rewarded by finding an abundant supply of water. This was not a chance find, but the reward of great geological knowledge. He would advise every member to study geology in its relations to underground water. He was a member of one of those much-abused bodies—a Local Board, and knew something of the other side of the question. They were simply custodians of the public purse, and had to satisfy themselves and the ratepayers at large that an undertaking would be a successful one. From what he had seen of those works he hoped all Local Boards would be as fortunate in the choice of their engineer as the Long Eaton Local Board in the choice of Mr. Hodson.

The President said before calling upon Mr. Hodson to reply he must add one word of congratulation both to Mr. Hodson and to themselves on having such a valuable paper on water supply. He could fully appreciate Mr. Hodson's difficulties in providing not only the means of supplying the water, but, as it were, the water itself, difficulties that northern engineers had not to encounter.

The vote of thanks having been accorded,

Mr. Hodson, in reply said, he was pleasantly surprised that he had not a number of criticisms to meet and reply to. He thanked the members for the manner in which they had received the paper and for the approval they had expressed of the works.

The members then returned in brakes to Derby. The arrangements for the meeting were admirably supervised by Mr. A. T. Davis, County Surveyor of Shropshire, and Hon. Sec. for the Midland district.

THE MANCHESTER SHIP CANAL.

WE recorded, a fortnight ago, a visit paid by the Incorporated Association of Municipal and County Engineers to the Barton section of the Manchester Ship Canal, and gave some particulars of the engineering works at Barton Locks, Barton-bridge, and Barton Aqueduct. We now give some further details of the work as a whole, which we cull from some particulars kindly placed at our disposal by the Engineer-in-Chief of the work, Mr. E. Leader Williams, M.Inst.C.E.

The Canal is the outcome of a series of long investigations in Parliamentary Committees in the years 1883, 1884, and 1885. Its supporters, who spent 150,000*l.* in obtaining the Act, were the manufacturers and merchants of Manchester and the neighbouring districts, and its principal opponents were the Corporation and Dock Board of Liverpool, and the railway companies.

The object of the promoters was to cheapen the cost of carriage by bringing large steamers and other vessels from the sea to Manchester, avoiding the heavy landing and carting charges at Liverpool, and reducing by one-half the railway and dock rates.

The original plan was to form a ship canal between Manchester and Runcorn, and from the latter place, to deep water near Liverpool, to dredge a channel down the centre of the tidal estuary of the Mersey. This channel was to be maintained by training walls, which were to be constructed of rubble stone on the slopes of the dredged channel, up to, but not exceeding, the height of the adjacent sandbanks. This proposed work gave rise to great controversy, the opponents of the Canal stating that it would cause the same accretion in the Mersey that had occurred in the Seine, Dee, and other rivers, where the training walls were carried up high above the sandbanks. Although the work as originally designed was passed by the first Select Committee of each House of Parliament to which it was referred in the Sessions of 1883 and 1884, it was not approved by the Committees who held the second and final inquiries in those years.

The promoters then resolved to adopt the plan the execution of which is now approaching completion, that, namely, of avoiding the centre of the estuary, and constructing a locked canal along its southern shore, in most cases inland, but partly on its foreshore where necessary to cross embayments to ensure a better line of navigation. The point selected for the entrance to the Canal from the tideway is at Eastham, six miles above Liverpool. Near this point there is a channel navigated by ferry steamers even at low water. This channel has been dredged to a depth that will give 30 ft. at high water of neap tides and 40 ft. at spring tides, so that large vessels will be able to navigate the entrance channel during a great part of each tide, and vessels of moderate draught almost the whole of each tide.

Locks have been constructed at Eastham which will admit vessels at almost any state of the tide; the lower sills of these locks are 3 ft. deeper than the entrance channel. These locks are three in number, of various sizes, viz. :—600 ft. long by 80 ft. wide; 350 ft. long by 50 ft. wide; and 150 ft. long by 30 ft. wide; and in addition there are two sluices of 20 ft. wide each for assisting in filling the Canal, the water level of which will be 14 ft. 2 in. above the Old Dock sill at Liverpool, which is about the level of mean high water. This group of locks will admit of the passage of a very large amount of shipping every tide, more particularly as on all tides above the ordinary level of the Canal all the lock gates will be open for a considerable period before high water. Spring tides will rise from 5 ft. to 7 ft. above the ordinary level of the tidal portion of the Canal, which extends to the next group of locks at Latchford, a distance of 21 miles.

The total length of the Canal is 35½ miles. From Latchford to Manchester (a distance of 14½ miles) the canal will be filled with the waters of the Mersey, Irwell, and other rivers. The canal being designed to take the place of the Rivers Irwell and Mersey from Manchester to Latchford, it will thus become a canalised river, continuing to be the main drain for Lancashire and Cheshire, large sluices being provided at each set of locks to deal with land floods and surplus water.

Owing to the sewage of Manchester, Salford, and all the other towns on the Rivers Irwell and Mersey and their tributaries being allowed to flow into the rivers without purification, the state of the water has become very bad. Salford has now completed a system of intercepting sewers, and has constructed works for purifying its sewage at Mode Wheel. Somewhat similar works are now being constructed by Manchester,* and as the turning of crude sewage into rivers or streams is contrary to the law as well as injurious to health, the other towns above Manchester are taking steps to prevent their sewage polluting the canal.

In the tidal portion of the Canal between Eastham and Latchford, twelves miles are inland, and nine miles on the foreshore or bed of the tideway; on this portion embankments have been formed. Where the foundation is rock or clay they are formed of clay hearting protected by heavy stonework. In some cases, where the bases of the embankments are on sand, close piling is driven on each side of the foot of the embankments. The embankments are generally 30 ft. wide at the upper surface, with outside slopes of 1½ to 1, and inside slopes of 1 to 1. At Runcorn, where the Mersey is not so wide as lower down the river, instead of an embankment, a concrete wall has been constructed.

In addition to the locks and sluices at Eastham to allow of the flow of the tide into and out of the estuary portion of the Canal, when the tide rises above the ordinary water level, three weirs, each 600 ft. long, have been constructed in the embankments. In the embankment opposite the river Weaver, ten large sluices, each 30 ft. wide, have been built to allow of the passage of the Weaver water out of the Canal. These sluices will also be used for tidal flow. They are on Stoney's patent, working on a movable frame of rollers, and being balanced, they work with great ease, only requiring slight power to lift them.

The River Weaver embankment will pen the water up that river to Frodsham, a distance of three miles from the Canal, thus forming a large sheet of water available, after dredging, as a dock for vessels of any size. This large dock is joined to the Weaver Navigation by a lock 229 ft. long by 42 ft. wide, which will admit the salt trade of Cheshire to the Ship Canal. Large locks have been built in the embankments at Weston Point and Runcorn to allow coasters and barges to enter and leave the Canal to and from the docks at those points. The shipping at Ellesmere Port will use the canal and locks at Eastham, this arrangement having been made to avoid the construction of a lock in the embankment at Ellesmere Port, as originally proposed.

At Runcorn, after passing under the viaduct of the London and North-Western Railway, the canal leaves the estuary through a deep cutting, and again approaches the Mersey at Old Randles, where two sluices, each 30 ft. wide, will enable tidal or river water to be let in or out of the Canal.

The Canal has been excavated throughout its whole length to a minimum width of 120 ft. at the bottom, and averages 172 ft. wide at the water level. The upper portion, from Barton to Manchester, is 170 ft. wide at the bottom, and 230 ft. at the water level. At the various locks the canal is widened out considerably, and will admit of vessels turning, if necessary. The width adopted will allow of large steamers passing each other at any part of the canal, and where works are built on the sides of the canal for manufacturing purposes, the Canal will be widened out to allow of shipping lying alongside wharves without interfering with the passage of vessels up and down the Canal. The minimum depth of the Canal will be 26 ft., the lock sills being 28 ft. below water level, to allow of future deepening of the Canal by dredging.

At Latchford the locks are two in number, the larger being 600 ft. long by 65 ft. wide, and the smaller 350 ft. long by 45 ft. wide. At Irlam, 7½ miles above Latchford, similar locks have been constructed, as well as at Barton, 2 miles above Irlam, and at Mode Wheel, 3½ miles from Barton. These last-named locks form the entrance to the Manchester Docks, which extend 1¾ miles above Mode Wheel.

The total rise from the ordinary water level of the Canal at Eastham to the docks at Manchester is 60 ft. 6 in. This rise divided between the four sets of locks gives an average rise of about 15 ft. 1½ in.

All the lock gates are constructed of green heart, a very hard wood imported from Demerara, which has been found by experience to be exceedingly durable, and the gates are less liable to damage than those made of iron. The gates are worked by hydraulic power provided at each set of locks; the engines and machinery are being constructed by Messrs. Sir W. G. Armstrong, Mitchell, & Co.

To let off flood and other spare water, sluices on Stoney's patent are provided similar in size and

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* Described in detail in the *Builder* for May 6 last.

design to the sluices erected at the mouth of the River Weaver. There are four of these sluices erected by the side of the locks at Mode Wheel and Barton, and five at Irlam. At Latchford only three are required, as the flood waters of the Mersey will flow down the river channel through Warrington from the point above Latchford, where the Canal leaves the river, taking an independent course inland until it enters the Mersey again at Runcorn.

Near Warrington, where the railway lines of the London and North-Western and Great Western railways cross the Canal, they have been raised by the construction of high level deviation railways (about 1¼ miles long on each side of the canal) so as to allow of shipping passing under the railway bridges. The railways between Warrington and Stockport, and the Cheshire Lines Railways near Irlam, have also been similarly deviated at a high level. The total length of railway deviations is 11¼ miles. The railway viaducts over the Canal are in most cases considerably on the skew, and the clear spans of the openings vary from 266 ft. to 137 ft., these large spans being necessary to enable the full navigable width of 120 ft. being maintained for the canal under the bridges.

There are two high level road bridges and six swing road bridges between Runcorn and Barton; the span of these bridges is in all cases not less than 120 ft. The minimum headway under the high level railway and road bridges is 75 ft.

The swing bridges will be worked by hydraulic power, as well as the movable aqueduct which will enable vessels with fixed masts to pass the smaller canal at Barton. This work will have two openings of 90 ft., each which will be crossed by a long iron caisson resting on a central pier.*

The docks at Manchester will have an area of water space of 114 acres, the area of quay space being 152 acres. The length of quays will be 5¼ miles. At Warrington there will be a dock having an area of 23 acres. At Partington the Canal is widened out to allow steamers to lie on either side, and branch railways will be constructed with hydraulic coal tips to enable either Lancashire or Yorkshire coal to be expeditiously loaded into the shipping.

With the use of the electric light, steamers will be able to navigate by night as well as by day, and the whole length of the Canal will be traversed in about ten hours.

The Canal passes through either red sandstone rock or marl—alluvial deposits of clay, gravel, sand, or loam overlaying the sandstone rock. These strata have been favourable for the work, the rock, where suitable, being used for pitching the slopes of the Canal where the soil is soft and requires protection from the wash of steamers, or for buildings or concrete. Excellent clay for bricks has been found, and 450,000 bricks per week were made at the contractors' brickyard near Thelwall. Large quantities have had to be bought, as about 70,000,000 were used on the works. The gravel and sand have been used for concrete, of which 1,250,000 cubic yards were required.

Concrete has been used wherever practicable in dock and lock walls. The copings and hollow quoins are of Cornish granite, while hard sandstone from quarries in Yorkshire, Derbyshire, and Cheshire, and limestone from Wales, are used in other portions of the work.

All the brickwork is faced with blue bricks. The total amount of brickwork required was 175,000 cubic yards, in addition to 220,000 cubic yards of masonry.

The lower portions of the dock and lock walls are formed of concrete, the culverts being lined with masonry or brickwork. At the water level, granite or limestone fender-courses, slightly projecting from the face of the wall, are inserted, to protect the concrete facing. Above this level the concrete walls are lined with brickwork. Culverts are built in the upper portions of the dock walls for hydraulic and gas mains.

For the excavation of the canal more than 100 steam excavators of various types have been employed, some of which have been constructed in France and Germany. To convey the earth to the spoil grounds, and for other purposes, 173 locomotives and 6,300 waggons and trucks were at one time employed, 223 miles of railway having been laid alongside or in the bed of the Canal. The rate of excavation has varied from ¾ to 1¼ million cubic yards per month. As much as 2,400 cubic yards has been excavated in 10 hours by the German excavating machines, but their average would be less than 2,000 cubic yards. Like the French type of excavators, they are land dredgers, suitable only for soft soil. The English excavating machines have in good soil at times reached nearly 2,000 cubic yards per day, but their average in all soils would be about 700 cubic yards. They are, however, capable of excavating very hard material, and even rock, when powder is used in advance of the excavator. There were 124 steam cranes, 192 portable and other steam engines, and 212 steam pumps employed on the works, and they consumed about 10,000 tons of coal per month.

The deepest cutting is near Runcorn, where, for a short distance, the depth is 66 ft. The largest cutting is at Latchford, where, for a distance of 1½ miles, the depth averages 55 ft. The slopes of the cuttings vary with the nature of the soil, from 1 to 1 to 2 to 1. In the rock cuttings the sides are nearly vertical.

The total amount of excavation in the Canal and docks amounts to about 46,000,000 cubic yards, 10,000,000 cubic yards of which is sandstone rock. The spoil from the canal has been used in filling up the river bends which are cut off by the Canal, and in raising the low-lying lands near, so as to make them available for being used for shipbuilding and other purposes.

The Canal, from Warrington to Manchester, being free from tidal influence, the water level will be always the same, and lay-byes or side docks can be cheaply constructed at any point, as gate entrances will not be required.

A paper read by Mr. Leader Williams before the Institution of Mechanical Engineers in 1891, on "The Mechanical Appliances employed in the Construction of the Manchester Ship Canal" gives some interesting statistics as to the labour and plant employed in the construction of the Canal, which is, it need scarcely be said, the largest work of its class in this country. The number of men and boys employed on the works was at one time about 17,000, and about 200 horses were used. The 228 miles of contractors' railway cost 630*l.* per mile of single line. The rate of excavation varied from 750,000 cubic yards to 1,250,000 cubic yards per month. As soon as the contractor, the late Mr. T. A. Walker, got possession of the land, he showed great energy in erecting huts, hospitals, and chapels for the workmen, and much honour was due to him, not only for the way in which he pushed the work forward, but for the care taken for the comfort and welfare of the men. The greater part of the plant was specially constructed for the work; the remainder was principally brought from Mr. Walker's contracts at the Severn Tunnel and Preston and Barry Dock Works. The total cost of the plant, &c., was 943,610*l.*

Into the question of the cost of the Canal itself we will not here enter, beyond saying that the total capital of the Company in March, 1891, was 10,900,000*l.*, of which 9,000,000*l.* had then been spent, and 3,900,000*l.* more was then required. This has since been raised, we believe, by the assistance of the Manchester Corporation and other bodies interested.

As we have before stated, it is confidently expected that the Canal will be completed and opened throughout for traffic early next year.

* See *Builder* for May 6 last, p. 370.

ARCHITECTURAL SOCIETIES.

EDINBURGH ARCHITECTURAL ASSOCIATION.—The annual meeting of this Association was held on the 10th inst. in the Royal Institution, Edinburgh, Mr. W. W. Robertson, President, in the chair. The reports of different officials were submitted, that of the treasurer showing that the income for the year, including a balance from the previous account, was 325*l.* 19s. 6d., and the expenditure 250*l.* 11s. 3d., leaving a balance of 75*l.* 8s. 3d. at the credit of the Association at the end of the year. The total membership of the Association, it appeared, was 279. Mr. W. W. Robertson was re-elected President. The other appointments were:—Vice-presidents, Dr. Rowand Anderson and Mr. Thomas Ross; secretary, T. Fairbairn; treasurer, Mr. J. Johnston; and librarian, Mr. Ross. Mr. Hippolyte J. Blanc, A.R.S.A., then read a paper on Corstorphine Church. At the outset, the lecturer spoke of collegiate churches in general, and said they came next in importance to abbeys, and succeeded them. Corstorphine Collegiate Church, dedicated to St. John the Baptist, was erected by Sir John Forrester in 1429, and originally comprised a chancel, nave, with north and south transepts; and sacristy, western tower, and porch. The nave was enlarged and the north transept extended about the beginning of the present century. The tombs of the three members of the Forrester family were next referred to, and reference was made to the sedilіæ, piscina, and other features of the church. At the conclusion of this paper, which was illustrated by lime-light views, the President delivered his valedictory address. Speaking first on the relations between the Royal Scottish Academy and architecture, Mr. Robertson referred to the fact that the Academy did not at one time recognise architecture as one of the fine arts. He next spoke of the steps which had been taken to remove that feeling, and said that at that time architects had thought their efforts had been fruitless, but they now found that such was not the case. Eighteen months ago there was not one architect in the Academy, and now there were nine. As soon as the hands of the Academy were free, it set itself as far as in its power to redress some of the things complained of. He thought they should give the Academy a word of appreciative recognition for that step, and wish for it a career of increased prosperity. Mr. Robertson next spoke of the new school of applied art, the success of which had exceeded their most sanguine expectations. Their paramount duty in regard to old buildings, he said, was preservation. Their discussions had shown no disagreement on that head, and they had also been useful in bringing out the great advance in their ideas of restoration—a word always doubtful but now inapplicable. The object in dealing with old buildings should not be to make pretty buildings, but simply to preserve them.

ARCHÆOLOGICAL SOCIETIES.

BRITISH ARCHÆOLOGICAL ASSOCIATION.—At the meeting of this Association on Wednesday, May 17, Mr. S. Rayson in the chair, the preliminary programme of arrangements for the Congress at Winchester, to begin on July 31, was laid before the meeting. Mrs. Dent, of Sudeley Castle, exhibited some photographs taken during the recent excavations at Winchcombe Abbey, showing portions of the remains which have been found. Dr. Fryer reported the recent subsidence of part of the area of the ancient camp on Clifton Down, and rendered particulars of the interments which still remain. Mr. J. T. Irvine described a recent discovery at the external angle of the north transept and north aisle of Peterborough Cathedral. Excavation for a vault for the gas-engine of the new organ blower has revealed two curious slabs of Norman date. Beside these, five stone coffins were seen next the transept wall, most of which still retained their heavy lids. A sketch of one of the slabs was exhibited. Mr. Irvine also reported the existence of an early sculpture in Warden Church, Northumberland, of much interest. A paper was then read by Mr. E. P. Loftus Brock, F.S.A., on the recent discovery of the remains of Winchcombe Abbey, Gloucestershire, the excavation of which he had superintended for Mrs. Dent. The outline of the Abbey Church has been traced, and it was found to exist almost in line with the Parish Church, the two buildings having been close together. Nothing was visible above ground, the site being an orchard and gardens belonging to various owners. The church consisted of nave and aisles, transepts and presbytery; at the west end were two large tower-like pinnacles, and the existence of the lofty tower at the crossing, mentioned by old writers, traditionally, has been proved by the discovery of the massive foundations of the supports. The nave had cylindrical piers of Norman date, as at Tewkesbury and other neighbouring churches. Only the rough foundations remain, so completely was the huge building demolished.

STREET IMPROVEMENTS, BARNSLEY.—Major-General Crozier, Inspector of the Local Government Board, held an inquiry at Barnsley, on the 17th inst., into the proposal of the Town Council to borrow 19,550*l.* for street improvements. The money required is 15,000*l.* for New-street widening, the present 17 ft. to be made 40 ft. wide; 3,500*l.* for Church-street; and 1,050*l.* for Doncaster-road. At Church-street, the road, now 32 ft., will be made 40 ft. wide. At Doncaster-road steps and palisades will be removed from the street. Mr. H. Hersfield (Town Clerk) and Mr. J. H. Taylor (Borough Surveyor) explained the facts, and the inspector viewed the premises.

THE ENGLISH IRON TRADE.—The Whitsuntide holidays have caused a suspension of business in most branches, and in but few cases are there any changes in quotations. Pig-iron continues to move off slowly, and in finished iron little is doing. Tinplates show but slight change. The steelworks are only moderately engaged. Shipbuilders and engineers do not report much improvement in prospects. The coal trade is quiet.—*Iron.*

"OLD PARIS" AT WEST BROMPTON.

THE "Gardening and Forestry Exhibition," opened on the 13th inst. by H.R.H. the Duke of York, may possibly possess some merits of its own. As to that point, we will take a future opportunity of speaking; but whatever may be the attractions of Gardening and Forestry, the promoters of the Exhibition have added two other attractions, viz., Captain Boyton's "World's Water Show," and "Old Paris and the Bastille." These two supplementary "shows" were opened on Saturday last. Captain Boyton's "Water Show" has supplanted Buffalo Bill's "Wild West," that which was last year the arena for horsemanship having been converted into a shallow lake for aquatic performances of various kinds.

Close adjoining, on the land formerly occupied by the wigwams of Buffalo Bill's red Indians, a full-size model of the Bastille, or of three sides of it (transplanted, we believe, from the Paris Exhibition of 1889), has been erected, together with a representation, more or less exact, of the Rue St. Antoine as it was in 1789.

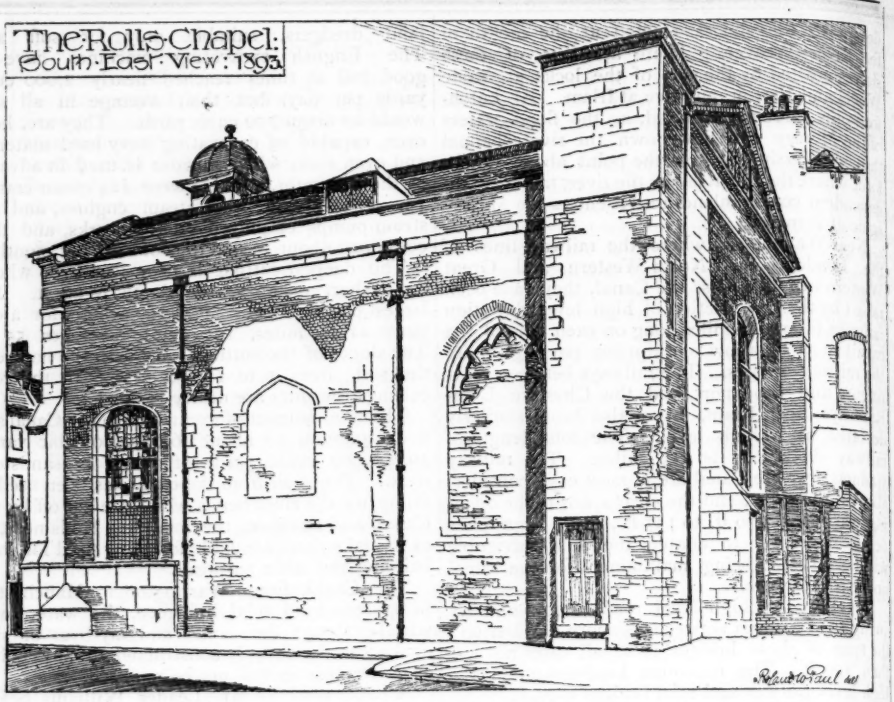
It is stated that the exhibition in 1889 of the model of the Bastille was so great a success that it was continued the following year, when it met with an equal amount of support. It afterwards occurred to M. Eugène Colibert, the architect of the reproduction of the buildings, to place himself in communication with Mr. Robt. Emeric Tyler, F.R.I.B.A., with a view to reproducing the buildings in this country. At that time no land in London which adapted itself to the purpose was available, and it was not until recently that the ground upon which it has now been erected was brought to Mr. Tyler's notice. A site in the Earl's Court Exhibition was secured. The work was placed in the hands of Mr. Frank Kirk, the well-known contractor, who at once attacked it with such vigour that what was but five weeks since a mound of earth is now almost a small town. This result is due to the energy and resources of Mr. Kirk, who has employed from 400 to 500 workmen of all trades continuously during the period named.

At the West Brompton end of the site, forming one of the two entrances to the exhibition, stands the Porte de la Conference, leaving which, on the right and left, are picturesque buildings, amongst others being the Hôtel de Mayenne, which will be appropriated to the purpose of a restaurant where *déjeûners* and dinners in the French style of that period will be provided, and the auberge, where refreshments of a cheaper kind will be obtained. Adjoining the auberge is one of the most striking features of the Exhibition, viz., L'Eglise St. Marie, its lofty dome reaching to an elevation of 90 ft. The interior of the church is utilised for the exhibition of tableaux connected with incidents of the Revolution. Facing the church are the hostelry of the Lyon d'Or and the Distillerie, and in the rear is a garden containing a dairy. The Place de la Bastille, which is now reached, forms a large open space, surrounded by buildings, finishing on the left at the Porte St. Antoine, which forms the second entrance to the exhibition, and on the left at the Porte de l'Arsenal. At the end of the Place stands the Bastille itself, surrounded at its base by houses. The old fortress (commenced in 1369 and completed in 1383) had six towers, reaching to an altitude of upwards of 80 ft. On passing through the Porte de l'Arsenal the entrance is reached through a garden and approached by two drawbridges which cross the fosse, one leading to the dungeons and torture chamber, and the other to the interior of the Bastille, which forms a large hall capable of seating one thousand persons. At the end of the hall is a stage, upon which pantomime and other entertainments will be given.

The whole of the works have been carried out by Mr. Frank Kirk, from the drawings, and under the directions of the joint architects, M. Eugène Colibert and Mr. R. E. Tyler, F.R.I.B.A.

REREDOS, ST. MARY'S CHURCH, PEMBROKE.—On the 18th inst. a new reredos, at St. Mary's Church, Pembroke, was unveiled. The new reredos cost 220*l.*, the work being designed by Mr. J. L. Pearson, R.A.

VALUE OF PROPERTY AT THE WEST-END.—We are informed that Messrs. Ball, Norris, & Hadley sold by auction last week the corner block of freehold property, comprising Nos. 241, 243, and 245, Oxford-street, two doors from Oxford Circus, for 16,300*l.*, a price equal to thirty years' purchase of the present rentals, or 23*l.* a square foot.



THE ROLLS CHAPEL.

WE give a sketch (from the south-east) of the exterior of the old Rolls Chapel, which is shortly to be incorporated with the new buildings of the Record Office. The building as at present existing is a simple rectangle with a projecting square stair-turret at its south-east angle. The interior has several interesting monuments of the past Masters of the Rolls, and in the windows north and south of the nave, and at the west end, is some good heraldic glass of the latter part of the seventeenth century. The Chapel is partly built of rubble stone work and partly of flint, this latter, with the windows, being an insertion of later date. One of the original windows, of fourteenth-century date, shows in our view, just west of the turret, and was found a little time back. It was of three lights—three cusped lancets under an enclosing arch. When the new buildings are complete, this chapel will be enclosed on the west and north sides, and it will not be possible to obtain a distant view of the south side.

Illustrations.

NATIONAL PROVINCIAL BANK, PICCADILLY.

WHEN the Directors of the National Provincial Bank of England acquired possession of the site upon which this building (the St. James's Branch of the Bank) stands, they found it occupied by a comparatively new and carefully designed block of ground floor shops with residential chambers above. The superior character of the building already holding the ground induced many efforts to retain the upper floors while re-arranging the ground and first floors to make way for the large banking chamber and its dependent offices, which were the chief requirements of the bank. It was gradually found, however, that such a course would not only entail many difficulties in construction, but would materially prejudice the arrangements of the new bank, and after all would absorb a very considerable percentage of the cost of a completely new structure. Accordingly it was reluctantly resolved to entirely pull down and rebuild from the foundations.

By adopting this course, not the least important advantage secured to the bank is the possession, in the basement of the new building, of an extensive range of well ventilated fire and damp-proof strong rooms lined with glazed brick.

The plan of the ground floor (see p. 409) needs little explanation. It will be seen that Piccadilly and Eagle-place form two sides of the site, the other two being occupied by the Museum of Practical Geology on the west, and by a large block of shops and chambers on the south. An entrance in Piccadilly, next the Geological Museum, gives access to the group of residential chambers, which occupy the whole of the building above the bank premises, from which they are carefully cut off at all points. The bank has its principal entrance at the angle formed by Piccadilly and Eagle-place, and two minor ones at the south end of the Eagle-place front, giving access to the manager's private room, to the messenger's residence, and to the heating apparatus chamber, which is carefully walled off from the rest of the bank basement. The large banking chamber has ample light secured (in addition to the windows) by a very large skylight over the clerks' space adjoining the museum, above which is an area lined with glazed brick, from which the chambers, staircase, and the various rooms at the back derive their light. The banking-room has two public waiting-rooms, and a special ground floor securities-safe; while in separate mezzanines are found a stationery-room and the messenger's residence, each with its separate stair of access. Clerks' luncheon and retiring rooms, coal places, and the like, are placed in the basement, completely severed from the cellarage allotted to the chambers. Of these chambers there are four suites on each of three of the upper floors, each suite having sitting and bedroom, bath-room, lavatory, w.c., and luggage space, all approached by both a good staircase and a passenger lift. On the fourth floor are only two suites of chambers (towards Piccadilly), the rest of this floor being occupied by kitchen offices, housekeeper's and female servants' rooms, while a small fifth floor is given to men servants' rooms, linen storage, &c.

The whole of the floors and partitions of the upper floors are of coke breeze, clothing a skeleton framework of iron and steel construction, while the roof is also fireproof, the rafters being of iron and the flats and gutters of concrete, covered with lead.

The banking chamber is, in great part, faïence-lined, with a ceiling of enriched plaster.

The exterior is entirely of Portland stone, with the exception of the two grey granite columns and the door casing of the bank entrance.

Messrs. W. Brass & Son have undertaken the erection of the building, while the iron and steel construction has been entrusted to Messrs. Handyside & Co., of Derby; the carving to Mr. Pomeroy and Messrs. Farmer & Brindley; the faïence to the Campbell Brick and Tile Co.; and the ornamental ironwork to Messrs. Hart, Son, Peard & Co.

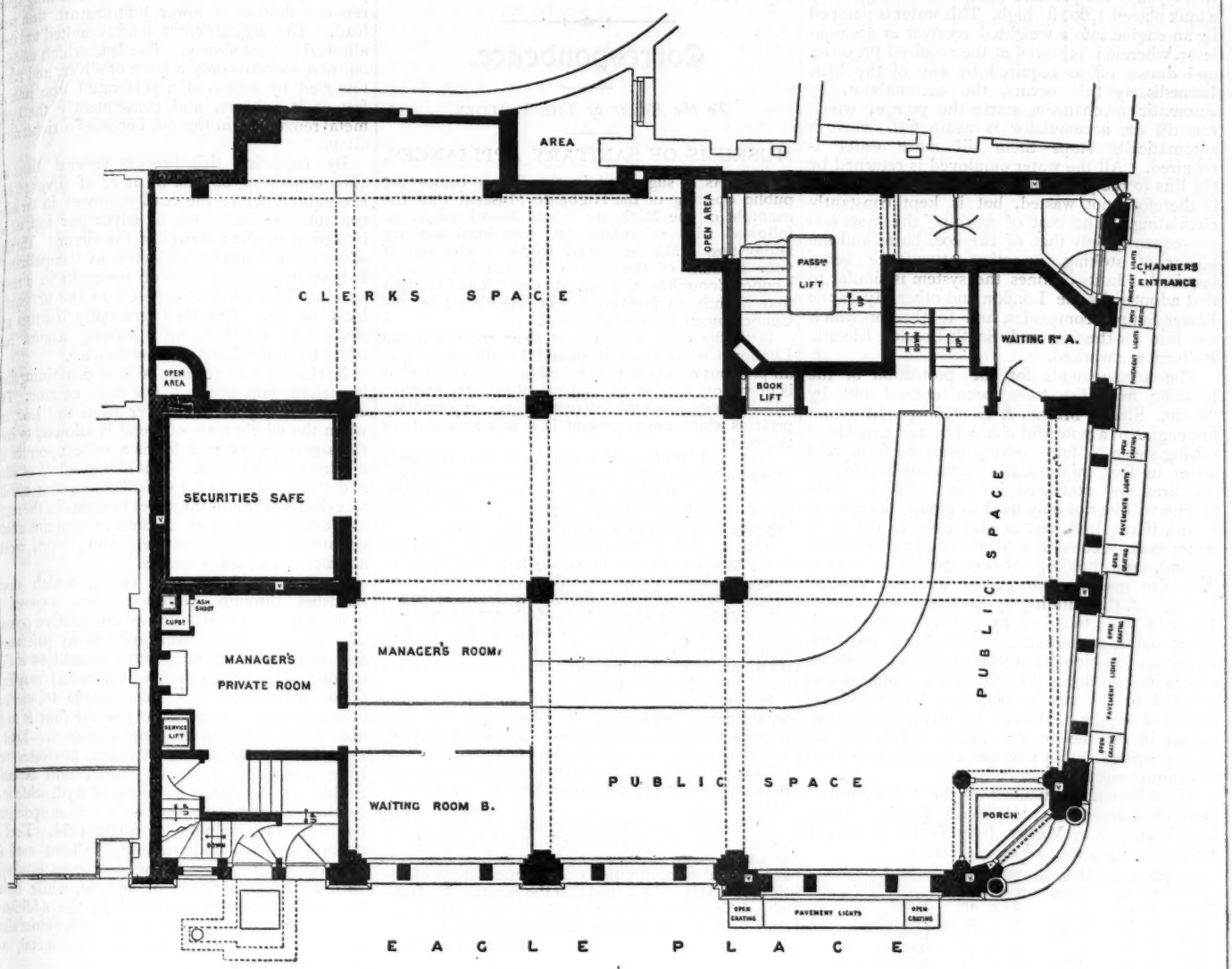
The architects are Messrs. A. Waterhouse & Son.* The drawing is a line-shaded copy of Mr. Waterhouse's coloured drawing in the Royal Academy Exhibition.

GROVE HILL COTTAGE, HARROW-ON-THE-HILL.

THIS small house was specially planned for the site, which has a drop of 30 ft. in its length; the

* In describing the building on the plate as by "A. Waterhouse, R.A.," we have followed the Academy catalogue, according to which the design is exhibited in Mr. A. Waterhouse's own name only. The written description furnished to us since gives it as the work of "A. Waterhouse & Son

THE NATIONAL PROVINCIAL BANK OF ENGLAND LIMD
NEW PICCADILLY BRANCH



GROUND FLOOR PLAN

SCALE OF FEET

rooms therefore are placed at all sorts of levels, producing a more picturesque interior than appears from the plan. Red brick and tile are the materials employed. Mr. S. Grist, of Aylesbury, was the builder, without competition. Messrs. Hayward specially coloured the friezes. Mr. Hoggett carried out the decorations. The carving is by Mr. J. E. Knox. The plaster ceiling modelled by Messrs. Jackson.

The architect is Mr. Arnold Mitchell, and the drawing is exhibited at the Royal Academy.

SCULPTURAL DECORATIONS TO THE "WOMEN'S BUILDING," CHICAGO.

THE bas-reliefs here indicated form part of the decoration in the vestibule of the English portion of the "Women's Building" at Chicago, which has been entirely designed by women, and is to contain examples of productions of art and industry by women. The two artists are Miss E. M. Rope and Miss Elinor Hallé, whose work as sculptors and modellers is well known in this country.

The work consists of bas-reliefs filling the spandrels of the arcade in the entrance vestibule. The subjects illustrated by Miss Rope are "Faith," "Hope," "Charity," and "Heavenly Wisdom," the Σοφία of the Greeks, who was regarded as the mother of the virtues, and is giving drink from the fountain of wisdom. "Hope" is represented as struggling with despair; "Faith" lighting the world with her lamp; "Charity" in her aspect of sheltering love.

Miss Hallé has taken subjects which illustrate specially womanly virtues—"Purity," "Fortitude," "Peace," and "Sympathy."

We may add here that the sides of the vestibule are decorated with paintings by Mrs. Swynnerton and Mrs. Anna Lea Merritt, representing the occupations of women—such as teaching, nursing, embroidery, &c.

THE IMPERIAL INSTITUTE.

A FORTNIGHT ago we briefly chronicled the opening of this building by the Queen; but although we had previously given a general description of the building (see *Builder* for June 25, 1892), there are one or two special points to which we may now refer in detail.

Very complete arrangements have been made for warming and ventilation. Nearly the whole of the basement area of the front building is formed into air-chambers under the basement floor, with a sub-basement corridor running the whole length, and fresh air is brought into these chambers from the outside atmosphere at thirty-two different places, where it is filtered and moistened by passing through a water-spray. In the winter it is warmed in its passage over a series of gilled steam-pipes, and thence conducted to the various rooms in vertical ducts, discharging itself through air valves in the chimney-breasts, controlled by regulators. The whole of the warming is by steam, and the mains to the various heating chambers are carried in the subway, where they are fitted with control cocks to each separate section under the immediate supervision of the Engineer of the establishment, enabling him readily to regulate the amount of heat, without the necessity of going into the building. The fresh air admission valves are also worked from the subway, by which the quantity of fresh air which is admitted can also be regulated. The whole of the corridors and galleries can be warmed by steam radiators, provided with fresh air ventilating tubes through each pipe, and having fresh air admitted to the bases from the outside atmosphere. The vitiated air is taken from every room and corridor by means of extraction shafts built in the walls, and fitted in the rooms with what are described as self-acting floating valves. The whole of these shafts are connected into four main trunks or ducts in the roof, and are carried to the central tower, where they discharge into the open air. To facilitate the extraction of this vitiated air, a pair of engines with a compressed air plant and receiver is fixed in the general engine-house, and the compressed air is taken to the roof and coupled up to the main trunks in several places, and the ends of the pipes are fitted with gun-metal nozzles for inducing a rapid outflow of the atmosphere of the rooms into the outer air, and to cause a constant renewal of the fresh air passing through the various rooms, warmed in the winter and cooled and moistened in the summer. The whole of the work was carried out by Messrs. Clements, Jeakes, & Co., who also carried out the fitting up of the extensive kitchens, larders, and sculleries, which are situated on the top floor, for the service of the Refreshment Department.

The lifting machinery, designed and erected by Messrs. Archibald Smith & Stevens, consists of eleven hydraulic lifts, with pumping engines and power storage plant. There are two passenger lifts running from the ground-floor to the second-floor; three lifts for the reception and distribution of coals and general stores; three appropriated to the kitchen department; one for the delivery of refuse from the engine and boiler-house; one heavy machine capable of raising a ton up to the central shaft of the east tower, and designed for dealing with stores and large objects for the

museum; and, finally, a 3-ton lift for raising extra large exhibits to the upper floor of the great gallery running east and west. All these lifts are supplied by water at 700 lb. pressure per sq. in., *i.e.*, equal to the pressure which would be given by a tank placed 1,600 ft. high. This water is pumped by an engine into a weighted receiver or accumulator, wherein it is stored at the required pressure, and drawn off as required by any of the lifts. Immediately this occurs, the accumulator, by automatic mechanism, starts the pumps, which run till the accumulator is again full, when it automatically stops them till more water is required. All the water employed is returned by the lifts to the pumping machinery for re-use, and is therefore not wasted, but is kept constantly circulating. The cost of working the system is consequently only that of the coal burnt and the labour of stoking, no other attendance being required. In its outlines the system is similar to that adopted by the London and other Hydraulic Power Supply companies, and to that on which the lifts for the City and South London Electric Railway are worked.

The arrangements for the protection of the building from fire have been carried out by Messrs. Shand, Mason, & Co. A special steam fire engine of a powerful character, and capable of raising steam to full working pressure from cold water in four minutes, has been constructed by the firm and stationed in the building. This engine will be not only used to pump direct upon a fire, if required, but is also used to fill large water tanks erected at a height of 130 ft. from the ground, and holding 25,000 gallons of water. The fire mains, with eighty hydrants erected throughout the building by the same firm, are fed either by these tanks or by the water company's street mains, an automatic valve being provided by means of which the greater of the two pressures comes into service. The steam fire engine is also coupled to the fire mains, and forms a third source of supply. Most of the hydrants are contained in recesses in the marble walls, and are each provided with a new and expeditious method of running out the hose.

The following particulars of the "Alexandra" peal of bells in the "Queen's Tower," which have been cast by Messrs. John Taylor & Co., of Loughborough, may be of interest:—

Bell.	Diameter. ft.	in.	Musical Note.	Weight cwt.	qrs.	lb.	Name.
Treble	2	4½	F	6	2	16	Maud.
2nd	2	6½	E flat	7	2	21	Victoria.
3rd	2	9	D flat	8	1	5	Louise.
4th	2	10	C	9	0	19	George.
5th	3	1½	B flat	10	3	14	Albert Victor
6th	3	4⅝	A flat	13	1	18	Arthur.
7th	3	8½	G flat	16	2	19	Alfred.
8th	3	11½	F	20	2	24	Alexandra.
9th	4	4½	E flat	27	0	0	Albert Edward.
Tenor	4	11⅝	D flat	38	1	15	Victoria, R.I., 1837–1887.
Total Weight....				158	3	11	

Each bell has cast around the shoulder:—

"ELIZABETH M. MILLAR GAVE ME—
THE LOUGHBOROUGH TAYLORS MADE ME."

On the eighth bell is the following additional inscription:—"The peal of which this bell forms one was by special permission of the Princess of Wales named after her Royal Highness.

The gold and jewelled key which was presented to the Queen for use at the opening ceremony was made by Messrs. Chubb & Sons, Limited. The wards of the key form the letters I. I., the initials of the Imperial Institute. The gold and diamonds of which the key is composed have been contributed by several Colonial Governments, and by India, so that different portions of the British Empire are represented by its various component parts. The design of the head is circular, with the Royal and Imperial crown on the summit, and the Maltese cross with *fleur-de-lis* of the Royal coronet forming the outer border. This joins the stem of the key by descending curves, decorated with shields and the enamelled national symbols, rose, thistle, and shamrock. The obverse shield bears the arms of the United Kingdom, the reverse those of England alone. The chief features of the head are the Grand Stars of the Indian and Colonial orders given in exact fac-simile on a slightly-reduced scale.

The electrical apparatus, whereby electric communication was made with the belfry to start the peal of bells on the opening day, was designed and erected by Messrs. Julius Sax & Co., Limited, under the personal supervision of Mr. Alfred Slatter, their manager, as well as the electric lighting of the Queen's lift, and complete telephonic and bell communication throughout the building.

The following illustrations of the building have appeared in the *Builder* of the dates named: Mr. Collcutt's design, as submitted in competition, July 2, 1887; plans and detail of *façade*, July 9, 1887; large perspective view, January 5, 1889; and a large coloured view of the central tower, June 18, 1892.

Correspondence.

To the Editor of THE BUILDER.

MUSEUMS OF SANITARY APPLIANCES.

SIR,—As I suggested in the *Times* before the public opening of the Highgate Museum that the example of the Highgate Local Board might be followed with advantage by other local sanitary authorities, I am very glad to see at the end of your account of the visit of the London County Council Committee to Highgate that "it was thought that if such an institution was established by the Council much good would result."

With the great resources at their command the London County Council should be able to eclipse all previous efforts in this direction and to give what is now most needed by students of sanitary science, which is experimental instruction on many sanitary prolems which are at present in a nebulous state of theorism.

Both the Parkes Museum and the Highgate Museum have models of house drainage, but they are on such a small scale as to be practically valueless in illustrating the sizes of soil and ventilating pipe necessary under varying conditions.

This is one of the points on which the sanitary safety of all, and more especially lofty buildings, in a great measure depends. Yet this subject is so much a matter of theory that an architect having a lofty building with many tiers of closets on one soil pipe has no scientific data to which he can refer to enable him to calculate, both in the sanitary and pecuniary interest of his client, what are the smallest pipes he could with safety use.

If this knowledge was only required by the architectural profession it might well be held responsible for the instruction of its own members, but it is equally necessary for surveyors, medical officers of health, and sanitary inspectors who are responsible for the administration of the Public Health Acts.

I should like to know how many of these public officers could lay down the law of drain ventilation and syphonage unless they happen to have had very exceptional opportunities of a practical study of the subject. It is to be hoped that the Sanitary Institute, with their recently acquired legacy, may also make their system of instruction more experimental.

ARTHUR BAKER.

TOMB IN WESTMINSTER ABBEY.

SIR,—Allow me to point out that the tomb figured on p. 388 of this week's *Builder* is not that of "*the Duke*" and Countess of Buckingham, but of *Sir George Villiers*, the Duke's father, and his second wife, the Duke's mother, created Countess of Buckingham in her own right after her husband's death.

H. E. THOMPSON.

*** Mr. F. D. Bedford, the artist whose signature is appended both to the drawing and the remarks, is responsible for the mistake. We merely published his drawing and comment, without accepting any responsibility for his statement.—ED.

The Student's Column.

CHEMISTRY.—XXI.

Symbol Pb. *Lead (Plumbum). Atomic Wt.* 207.

THE most abundant ore of lead is galena, a sulphide of lead, PbS. In smaller quantities ores consisting of carbonate, sulphate, and sometimes chloride of lead are found.

To reduce the ore to metallic lead, the galena is first roasted in contact with air in a reverberatory furnace until a certain proportion of the galena has become converted (1) into lead oxide and (2) into lead sulphate, thus—

1. $PbS + 3O = PbO + SO_2$.
2. $PbS + 4O = PbSO_4$.

When this stage is reached, air is shut out from the furnace and the temperature rapidly increased. That portion of the sulphide which was not converted into oxide or sulphate is now attacked by the lead oxide and sulphate which was formed by roasting, thus—

Metallic lead.

1. $2PbS + 4PbO = 3Pb_2 + 2SO_2$.
2. $PbS + PbSO_4 = Pb_2 + 2SO_2$.

Lead obtained from galena usually contains an appreciable amount of silver, which was present in the ore. Until comparatively recent times, this silver was left in the lead and hardened it to a very appreciable extent. The small percentage of silver is now extracted either by the Pattinson or the Parkes' process. Pattinson's process depends upon the fact that lead containing silver remains fluid at a lower temperature than pure lead. The argentiferous lead is melted and then allowed to cool slowly. The lead which solidifies out first contains only a trace of silver, and this is removed by means of a perforated iron ladle as fast as it appears, and consequently the liquid metal remaining in the pot becomes a richer silver alloy.

By repeating this process several times an alloy containing 80 ozs. or more of silver per ton is obtained, while the lead removed in the ladle contains less than 1 oz. of silver per ton, and is improved by the removal of the silver. The rich silver alloy is finally subjected to "cupellation." It is melted upon a bed of bone-ash in a reverberatory furnace, and exposed to the action of a blast of air. The lead gradually oxidises and sinks into the bone-ash, leaving almost pure silver upon the hearth of the furnace.

In the Parkes process the lead containing silver is melted with about 5 per cent. of zinc. This extracts nearly all the silver from the lead, and when the whole mass of metal is allowed to cool, the argentiferous zinc forms a cake upon the top of the purified lead. When this alloy of silver and zinc is subjected to distillation, the metallic zinc distils over and the silver remains in the retort.

Most of the lead of commerce contains minute quantities of silver, copper, zinc, iron, nickle, antimony, and other metals.

Lead is a bluish grey metal, which slowly tarnishes through oxidation when exposed to moist air. Lead salts act as cumulative poisons. The metal is appreciably soluble in soft water, and in water containing small quantities of CO_2 in solution. Although hard water has very little action upon lead, it is unadvisable to use lead tanks for the storage of any water that is to be used for drinking or cooking purposes. Lead is very ductile and malleable, but possesses very little tenacity. It is very soft, and is easily fusible. Cold dilute solutions of hydrochloric or sulphuric acids have very little action upon lead, but it is very soluble in nitric acid. Lead is much used for bullet-making. That used for making small shot for fowling-pieces is alloyed with about 5 per cent. of arsenic, while bullets for small arms are hardened by the addition of about 20 per cent. of antimony. The chief alloys of lead are pewter, solder, type-metal, and Britannia metal.

White Lead.

The powder known commercially as *white lead* is composed of lead carbonate, $PbCO_3$, and lead hydrate, PbH_2O_2. The proportions in which these two compounds occur differ somewhat in different samples. White lead cannot therefore be regarded as having a fixed chemical composition, although as a rule its composition approximates more or less to the formula $2PbCO_3 + PbH_2O_2$.

The best white lead, and that mostly sold in commerce, is still prepared by the old "Dutch process." In this process bars, sheets, or gratings of *cast* metallic lead, as pure as possible, are suspended in earthenware jars containing at the bottom a small quantity of crude vinegar (acetic acid). Several hundreds of jars thus charged with lead and acetic acid are packed upon a floor in a bed of stable manure or spent tan. This bed of jars is covered with loose planks and a second layer of jars similarly charged and imbedded in manure or spent tan is placed upon them. By repeating this process a stack is at length obtained which completely fills a chamber. The beds of manure or spent tan soon ferment, give off CO_2 gas, and become very warm, the temperature of the inner parts of the stack rising to 140 deg. to 150 deg. Fahr. The acetic acid at this temperature is slowly volatilised, and its vapour corrodes the metal, forming subacetate of lead, which, by the CO_2 vapour given off from the decaying organic matter is converted into carbonate of lead, with the liberation of acetic acid, which attacks a fresh portion of the lead. When this action has continued for from 6 to 10 weeks, it is found that all, or very nearly all, the lead has been converted into carbonate of lead, and that although the physical form of the castings is retained, they have considerably increased in bulk.

The material thus obtained is next passed through rollers, which crush the carbonate to a coarse powder and renders the separation of any unattacked metal easy. The white mass is then transferred to the mills, where it is ground into a

thin paste with water, and is reduced by successive washings into an impalpable powder; it is then dried in wooden bowls placed upon shelves over a stove, and finally appears as a dry, white, amorphous powder. If the metallic lead employed contained iron as an impurity, the resultant white lead possesses a yellow colour, while, if it contained silver, the powder assumes a brownish tint when exposed to daylight. The metal employed must also be *cast* lead; it is found that rolled lead will not answer the purpose.

There are many processes for manufacturing white lead by precipitating it from a lead solution, but as by these processes only carbonate of lead, $PbCO_3$, is produced, and not a carbonate containing a considerable proportion of hydrate as by the "Dutch process," the product is an inferior article, for it is found that the hydrate combines better with oil to form a paint. *Clichy white* is produced by one of the precipitation processes. Purified CO_2 is passed through a solution of subacetate of lead, which causes carbonate of lead to precipitate out and fall to the bottom of the vessel, while ordinary lead acetate remains in solution. According to Abney's "Notes on the Chemistry of Building Materials," white lead prepared by the Dutch process requires only 9 lbs. of oil per cwt. to bring it to the proper consistency for the painter, while the precipitated white lead requires 16 lbs. of oil per cwt.

White lead is blackened by exposure to air containing sulphuretted hydrogen, on account of the partial decomposition of the carbonate into lead sulphide, which is black.

$$PbCO_3 + H_2S = \underset{\text{(Lead sulphide.)}}{PbS} + \underset{\text{(Carbonic acid.)}}{H_2CO_3}.$$

Sometimes a small quantity of Berlin blue is added to white lead, to give it a faint bluish tint and hide the yellow colour of any iron present as impurity in it.

White lead is frequently adulterated with barium sulphate ($BaSO_4$), sometimes termed heavy spar; it is less commonly adulterated with chalk ($CaCO_3$); calcium sulphate or gypsum ($CaSO_4 + 2H_2O$); zinc oxide (ZnO); or sand (SiO_2).

The following analyses of white leads published by Mr. J. F. Liversedge show that their price is no criterion of their quality.

Analyses of White Lead.

	1	2	3	4	5
Price (per cwt.)	22s.	20s.	18s.	18s.	—
$2PbCO_3 + PbH_2O_2$ ..	78·75	69·14	64·20	88·04	87·72
Impurities	20·22	30·12	34·47	10·80	11·12
Moisture and loss	1·03	0·74	1·33	1·16	1·16
	100·00	100·00	100·00	100·00	100·00

Experiments. Group 12.

1. Make a qualitative analysis of some white lead ground in oil.

First remove the oil from a small portion by shaking it in a corked test-tube with benzoline. The white lead will settle down upon allowing the tube to stand for a short time, and the solution of benzoline and oil may be poured off. The powder in the tube should then be boiled with dilute HNO_3. A brisk effervescence should be caused by the decomposition of the carbonate. The whole of the lead carbonate will be dissolved, but any barium sulphate or sand will be left in the tube as an insoluble residue. Sand may be distinguished from barium sulphate by the fact that barium sulphate may be completely dissolved with difficulty in a considerable bulk of *strong* H_2SO_4, while silica is insoluble in this acid. Moreover, if barium suphate is placed on a piece of platinum wire, and held in the flame of a Bunsen burner it will impart a green colour to the flame; silica will not. Having filtered off any insoluble matter, HCl is added to the clear filtrate, which causes a considerable portion of the lead to be precipitated as lead chloride. The solution should be cooled in a stream of cold water if at all hot, as lead chloride is soluble in hot water. Filter off the white precipitate and to the filtrate add a few drops of NH_4OH, but take care that the solution remains distinctly acid. The solution must be only moderately acid for successful subsequent treatment. Pass H_2S gas through the clear solution. All the lead that was not thrown out as chloride upon addition of HCl, will now be precipitated as black sulphide. When no further precipitation can be obtained, filter off the lead sulphide and to the clear filtrate add excess of ammonium hydrate, ammonium chloride and ammonium sulphide. If zinc oxide, ZnO, was originally present a white precipitate of zinc sulphide will now be obtained, and must be filtered off. Boil the clear filtrate for some time, and then filter off any sulphur which separates out as a fine powder, produced by the decomposition of the excess of ammonium sulphide. To filtrate add ammonium carbonate; if chalk or barium carbonate ($CaCO_3$ and $BaCO_3$) was originally present, a white precipitate of calcium or barium carbonate will now be thrown down. To ascertain whether the white precipitate is caused by the presence of barium or calcium, collect and wash the precipitate, and then dissolve it in acetic acid. Add to the solution an excess of chromate of potassium solution. If a pale yellow precipitate is produced it indicates the presence of barium. If any precipitate is formed, filter it off, and to the clear filtrate add excess of ammonia and ammonium oxalate solutions. If a calcium salt was present, a white precipitate will now be formed.

2. Make a quantitative estimation of the oil and lead in a commercial sample of white lead in the following manner.

Weigh 5 grammes of the sample into a small beaker, then add enough redistilled benzoline to completely cover the white lead, and allow the beaker and contents to stand for a few hours. Then filter through a paper into a flask. Add another small quantity of benzoline, and again allow to stand for a short time, and filter off through the same paper. Repeat this process until it is found that no oily residue is obtained when a few drops of the benzoline are transferred from the beaker to a watch-glass and evaporated. Transfer the white lead which remains in the beaker to the filter-paper and dry it. The oil may be separated from the benzoline by distilling off the benzoline by means of a steam-jacket. The residue of oil should be dried at 212 deg. F., and weighed as soon as it is cool. It should not be forgotten that benzoline is a highly inflammable liquid, and therefore must not be brought near a naked flame.

Weigh 2 grammes of the dried white lead, from which the oil has been removed, and dissolve it by heating with dilute acetic acid. Filter off any insoluble matter, weigh it, and analyse it qualitatively. To the filtrate of lead acetate, which should not be too dilute, add a slight excess of dilute H_2SO_4 and twice its volume of methylated spirit. Collect the precipitate of lead sulphate on filter, and wash it two or three times with dilute methylated spirit. Dry the precipitate at 212 deg. F., and then detach it as far as possible from the filter paper over a glazed sheet of paper, being careful not to lose any of the precipitate. Ignite the filter paper in a previously weighed *porcelain* crucible. Allow to cool, add one drop dilute HNO_3 and one drop dilute H_2SO_4, and gently evaporate the acid to dryness. Finally transfer the whole of the precipitate from the glazed paper to the same crucible, heat the crucible and contents over a Bunsen burner, and when cool ascertain the total weight. The increase in weight is due to lead sulphate, $PbSO_4$, if the weight of the filter ash is disregarded. The object of separating the filter paper from the lead sulphate before ignition of the former is to prevent the decomposition of the latter by the carbon of the paper. Multiply the weight of lead sulphate obtained from 2 grammes of the white lead by 50 to give percentage amount of $PbSO_4$ yielded. White lead usually has a composition approaching the formula $2PbCO_3 + PbH_2O_2$; it is, therefore, necessary to multiply the percentage amount of $PbSO_4$, obtained by 0·8525, to obtain an idea of the amount of true white lead present.

$PbSO_4$ contains 68·316 per cent. Pb, while $2PbCO_3 + PbH_2O_2$ contains 80·129 per cent. Pb $\frac{68·316}{80·129} = 0·8525$, hence the above figure. Thus, a sample which yielded 109·2 per cent. $PbSO_4$, is regarded as containing 93·09 per cent. of white lead.

GENERAL BUILDING NEWS.

CHURCH TRAINING COLLEGE, BANGOR.—On the 19th inst. the Lord-Lieutenant of Carnarvonshire (Mr. J. E. Greaves) laid the corner-stone of the new North Wales Church Training College, now in course of erection at Bangor. The site of the new college is on the summit of the rising ground overlooking the city, near the railway station. The building will provide accommodation for sixty students. The principal entrance will be from a terrace crowning the brow of the hill, and from which access is had into the principal corridor, 100 ft. long by 10 ft. wide, and from thence to the lecture-rooms, three in number, and to the common-room, and by an intersecting corridor to the chapel, dining-hall, principal's study, &c. At the point of intersection, the main staircase, of York stone, is placed, and leads up to the two dormitories, each 100 ft. by 22 ft., with open roofs, and containing thirty cubicles each. Adjoining the dormitories are the assistant masters' rooms, the Principal's residence being placed at the west end of the block. From the south-east corner of the quadrangle a square tower will rise to the height of 60 ft. The style adopted for the external treatment of the buildings is Late Tudor Gothic of collegiate type. It is expected that the buildings, with the exception of the principal's residence, will be completed by the end of the present year. The total cost of the buildings, including fittings, will be about 10,000*l*. The architect is Mr. R. Grierson, of Bangor, the contractors being Messrs. Parnell & Son, Rugby.

MISSION HALL, BOLTON.—The foundation-stone of the Queen-street Mission Hall, Idle-lane, Bolton, was laid on the 20th inst. The building is of a plain but substantial character as to the exterior. Provision is made in the basement for a gymnasium, two large labour-rooms, and two bath-rooms. A soup kitchen with steam boilers, and a kitchen and heating apparatus room, complete the accommodation in the basement. On the ground-floor is the large hall, 66 ft. by 44 ft., with open pitch-pine roof, and with a gallery at one end; the body of the Hall will hold about 600. A large infants' room with gallery is provided, and four class-rooms of various dimensions, two of which can be opened to the Hall by means of revolving shutters, so as to provide additional space when desirable at public gatherings. On the upper floor is one large class-room, 24 ft. by 32 ft., and seven other class-rooms of various dimensions. The building will be heated with hot water. The contractors for the work are:—W. Kearns, excavator; J. Merrick, bricklayer; R. W. Kenyon, joiner; R. Walsh, plumber; A. Warburton, plasterer and painter; Gregson & Smith, masons; and J. Hodson, slater. Mr. W. J. Morley (late Woodhouse & Morley) is the architect. The total cost of the building and site will be over 4,000*l*.

PROPOSED ADDITION TO HOSPITAL, COOKRIDGE, YORKSHIRE.—It is proposed to erect a wing to the Cookridge Convalescent Hospital, to be called "The Edward Jackson Wing," in memory of the late Canon Jackson. The proposed addition will provide fifty more beds. The preparation of the plans has been intrusted to Mr. Walter A. Hobson, architect, of Leeds. The whole of the new wing is practically devoted to the provision of additional sleeping accommodation, with the exception of a portion which has been utilised for enlarging the existing dining-hall, and providing a men's new day-room. Externally, it will be carried out in harmony with the existing building, and will extend the present front 60 ft. to the east, and will run back to a depth of 72 ft. On the ground floor will be located the men's day-room, which will be 34½ ft. by 23 ft. This floor will also contain a staircase hall, 12 ft. in width, and 22 ft. in length, giving access on either side to dormitories for eight and twelve beds respectively. On the first floor a men's dormitory, 34½ ft. by 24 ft., and with accommodation for eleven beds, is placed over the men's day-room, and at right angles to it there are other two dormitories exactly similar to those on the floor below. The second floor is practically a repetition of the first. A staircase running from the ground floor to the top story gives access to the dormitories, which are placed on either side of it, and which can be ventilated into it. The new wing is L-shaped, and the lavatories, which are provided for every floor, are placed in the angle of the building. The existing men's day-room will be enlarged into a dining-hall, 57 ft. by 23 ft. The open path at the rear of the present building will be roofed with glass, and will be used as a winter garden, besides which it will serve to connect the men's smoke-room with the new wing and the other parts of the building. The dormitories, day-rooms, and entrance-hall will be warmed with hot-water from the existing boiler. The contractors for all trades are Messrs. Cross & Carter, of Leeds; Messrs. Thomas Green & Sons having been intrusted with the carrying out of the heating arrangements. The cost of the building, when completed, will be about 4,000*l*.

PROPOSED HOSPITAL FOR THE LEWS, STORNOWAY.—The movement for the establishment of a hospital at Stornoway, available for the whole population of the Lews, has been attended with such success that the committee have selected plans, which are to be carried out immediately, for a building of a commodious and substantial character. Some eight or nine designs were submitted by architects from Inverness and neighbourhood, and the committee unanimously chose the set sent in by Mr. John H. Gall, architect, Inverness. The approved plans show an arrangement for two wards to accommodate six patients each, separated by an administrative department embracing matron's room, doctor's room, central hall and vestibule, and two nurses' duty rooms. Behind these are the surgery and operation room, and the kitchen and kitchen offices. The laundry, washing-house, and mortuary are contained in a separate block. Above the administrative department are bedrooms for the matron, nurses, and kitchen staff, and a private or

separation ward with bathroom and other conveniences. Off each ward is an annexe containing lavatories and bathroom for the patients; and the whole arrangement has been so planned as to lend itself easily to future extension.

NEW MANUFACTURING PREMISES, BIRMINGHAM.—Alterations and additions have been completed at Messrs. Pickard & Lloyd's Tool Works, situated in Woodcock-street, Birmingham. This building, which was erected probably during the latter part of the last century, has practically been remodelled. The old blacksmiths' hearths and fittings, workshops, &c., have been removed, and others of a more modern and improved kind substituted. A large blacksmiths' shop, covered with glass, and with louvre ventilators, and a spacious tool-shop, &c., have been erected. The work has been carried out by Mr. Shergold, builder, of Aston, from plans prepared by and under the superintendence of the architect, Mr. J. Statham Davis, Birmingham.

MINERS' HALL, WEARMOUTH, SUNDERLAND.—On the 22nd inst. the foundation stones in connexion with the Wearmouth miners' new hall in Roker Avenue, Sunderland, were laid by Mr. Storey, M.P., Col. Gourley, M.P., Captain Fenwick, M.P., and others. Mr. J. W. Bell, of Sunderland, is the architect, and his plans provide for a structure of Sherburn brick, relieved with stone and terra-cotta embellishments, having a frontage of 123 ft., a depth of 44 ft., a height from the street level to the top of the ridge of 50 ft., and to the wrought-iron dome surmounting an ornamental tower, supported by the side walls of the entrance, 78 ft. There are to be three entrances from Roker-avenue. The principal means of ingress is immediately under the tower. It leads on the right to a pay office, a committee-room, a reading-room, and a billiard-room, with ante-room, &c. A staircase gives access to the level of the hall floor, which occupies the remainder of the main building. The hall is 68 ft. long, by 41 ft. across, with a height of 26 ft. to the ceiling-line. A gallery, 40 ft. by 20 ft., occupies one end; the platform is at the other end; and on either side there are retiring-rooms, with separate private entrances, and staircases leading to the rooms. The hall is estimated to accommodate 1,100 people. The gallery has its own staircase, and a way out of the back of the hall is provided. At either end of the main building is a house for the residence of the colliery checkweighman. The contract price for the hall is 4,123*l.* 9s. 9d. The work has been let to Mr. James Hudson.

GRAMMAR SCHOOL, DEWSBURY.—On the 19th inst. the Archbishop of York opened the Wheelwright Grammar Schools, Dewsbury, which have been built under the John Wheelwright Trust. The front elevation of the building faces the junction of Halifax and Birkdale-roads. The plan is on the Central Hall system. On the ground floor are the boys' rooms, the girls being accommodated on the first floor. In the basement are the dining-rooms, kitchens, workshops, lavatories, &c. The materials used in the construction of the building are Delphstone and Holmfirth ashlar dressings. The timbers are of pitch-pine, and the joiner's work is of yellow pine, stained and varnished. The architect was Mr. J. Lane Fox, of Dewsbury.

NEW POLICE-STATION, CARDIFF.—On the 19th inst. a new police-station was opened on the East Moors, Cardiff. The building occupies a corner site at the junction of Janet-street with Walker-road, and has a frontage to Janet-street of 70 ft. and to Walker-road of about 100 ft. It is constructed of Newbridge stone in narrow courses, with Bath stone dressings, and has a gabled front and projecting porches. The main building consists of inspector's quarters, police offices, and single constables' quarters. The inspector's quarters comprise parlour, kitchen, scullery, two bed-rooms, bath-room, &c. The police-offices contain:—On the ground floor, lobby and entrance-hall, inspector's office, charge-room, parade-room, store-room, lamp-room, boot-room, and six cells, each 10 ft. by 7 ft. by 10 ft. high; and on the first floor, men's mess-room, 18 ft. by 14 ft., four bedrooms, bath-room, lavatory, &c. The outbuildings consist of fire-escape and reel-shed, mortuary, lavatory, and exercise yard for prisoners. The cells and cell corridor are lined throughout with white enamelled bricks, and are heated by hot water on the small bore system, and are ventilated by two large Boyle's air-pump ventilators, fresh air being admitted by gratings in the walls. The whole of the cell corridor is immediately overlooked from the charge-room. The whole of the work has been carried out from designs prepared by the Borough Engineer, Mr. W. Harpur, the contractor being Mr. T. R. Waterman, and the clerk of works Mr. George Howell.

WESLEYAN CHURCH, BISHOPSTON, NEAR BRISTOL.—Memorial stones of the new Wesleyan church now being constructed at Bishopston were laid on Tuesday. The new church will be a Gothic edifice of the later Decorated period. The new church will provide seats for upwards of 600 worshippers, 500 being accommodated on the main floor, and about 100 in a gallery at the western end. The principal entrances are three in number, each facing the main road. The church will contain two aisles, a north and south transept, and an apse at the rear end. A doorway in the south transept affords communication with the existing vestry, school, and class-rooms. The main walls will all be in Pennant stone, with dressings, mouldings, and window and door openings in moulded Bath stonework. The upper portions of the windows will be filled in with tracery, and the treatment of the heads of the several door openings will harmonise with them. The roofs will be of moulded and varnished pitch-pine, and will be open-timbered for about one-half the height, relieved with traceried panels between the curved ribs and other principal timbers of the roofs. All the internal wood fittings will be of varnished pitch-pine, and the artificial lighting will be by gas. All the windows and the screens and doors in the entrance lobbies will be glazed with cathedral glass in geometrical designs. The warming of the church will be by means of a low-pressure hot-water apparatus. The architect is Mr. Herbert J. Jones, of Bristol. The contractors for the new church are Messrs. R. Wilkins & Sons, the estimated cost being about 3,000*l.*

RESTORATION OF CHAPEL-EN-LE-FRITH PARISH CHURCH, DERBYSHIRE.—The reopening, after restoration, took place on the 19th inst. of the Church of St. Thomas a'Becket, at Chapel-en-le-Frith. The work has been carried out by Mr. A. Hill, of Tideswell, under the direction of Mr. Smith, of the firm of Messrs. Darbyshire & Smith, architects, Manchester. The old features of the building have been retained and a new roof erected. A large window has been placed in the south side, and a west window in the north wall. An organ chamber has been erected on the south side of the chancel. Other improvements include a new pulpit and reading-desk, and the rearrangement of the chancel pews. All the monuments have been rearranged.

PUBLIC BUILDINGS, TREDEGAR, MONMOUTHSHIRE.—On the 17th inst. new public buildings at Tredegar were opened by Mr. J. Colquhoun, J.P. The buildings include a market-hall, which consists of butchers' stalls, twelve general shops, twenty open stalls, &c., and attached thereto a public slaughter-house. In addition to this, there is a Town-hall, which incorporates a county-court-room and offices, registrar's court and offices, store-room, local boardroom and offices, telephone office, lecture-room, judge's retiring and ante-room, high bailiff's office, and four solicitors' offices. The architect was Mr. Hitchcox, of the firm of Messrs. Graham & Hitchcox, of Newport, while the structural portion of the work was executed under the direction of Mr. David Davies, contractor, Cardiff. Mr. Edward Morgan, Tredegar, builder, has acted as clerk of the works.

CHANCEL, ST. STEPHEN'S CHURCH, CINDERFORD.—Three years ago the nave of the Church of St. Stephen, Cinderford, was consecrated by the Bishop of the Diocese. The church lacked the chancel tower, spire, and offices. The architect was Mr. E. H. Lingen-Barker, of Hereford, and the chancel has now been built from his design, the builder being Mr. W. Jones, Gloucester.

RESTORATION OF MARCROSS CHURCH, GLAMORGANSHIRE.—The ancient church of Marcross, on the coast near St. Donatt's Castle, is now being restored under the supervision of Messrs. Kempson & Fowler, of Llandaff. This church, says the *Western Mail*, has a very quaint chancel arch and south entrance of Norman date. A few days ago, while the walls were being stripped of the old plaster, the entrance doorway leading to the rood-loft on the north side of the chancel arch was discovered, also a thirteenth century recessed tomb in the north wall of the nave, with an incised floriated cross cut on the slab. The pillar piscina was also found. There is a leper window in the south chancel wall, low down. It is intended to clean and preserve the above, fix the piscina in its old position, and open out and glaze the small window. The roofs are all to be new, also most of the windows, floors, &c.

PUBLIC HALL AND INSTITUTE, TREHARRIS, GLAMORGANSHIRE. — On Whit-Monday a new Public-hall and Institute was opened at Treharris. The hall provides accommodation for over 1,000 people, and has a gallery. The stage measures 43 ft. by 19 ft. A broad flight of steps leads from the entrance up to the gallery, there being also three other exit staircases. Cloak-roam accommodation has been provided. The institute comprises reading-room, library, recreation-room, committee-room, and lavatory accommodation. The contract for the erection of the building was let to Messrs. Morgan & Roberts, of Newport; the lighting has been carried out by Messrs. Arnold & Co., Newport, the whole being executed under the supervision of Mr. T. R. Bates, architect, Newport.

VILLAGE INSTITUTE, HAWARDEN.—On Whit-Monday a new village institute was opened at Hawarden by the Prime Minister. The new building has a frontage to the main road. There is a lending library connected with the institute, which is also provided with a couple of billiard-rooms, a reading-room, a lecture-room, bath-rooms, &c. A portion of the building has been set apart as an armoury. The institute building has been erected at a cost of about 1,500*l.* Messrs. W. & T. Bailey were the builders, and Messrs. Lockwood & Sons, of Chester, the architects.

NEW CATHOLIC CHURCH AT SUDBURY, SUFFOLK.—A new Catholic church is about to be erected here, Mr. Leonard Stokes being the architect, and Messrs. George Grimwood & Sons, of Sudbury, the contractors.

SANITARY AND ENGINEERING NEWS.

CHESTERFIELD SEWAGE TREATMENT.—The Corporation of Chesterfield have decided to effect several improvements at their Sewage Farm, and have instructed Mr. Theo. S. McCallum, A.M.Inst.C.E., of Manchester, to prepare a scheme for the precipitation of the sewage and for dealing with the sludge.

AIRE AND CALDER POLLUTION: ELLAND DRAINAGE.—The Local Board of Elland have engaged Mr. Malcolm Paterson, M.Inst.C.E., of Bradford, to prepare a preliminary scheme for the drainage and sewage treatment of their town. Elland being a woollen manufacturing town on the River Calder, the scheme is to make provision for both trade and domestic refuse, a thorough policy now becoming general in the West Riding, as the only practical means of remedying the evils of the universal river pollution of the industrial rivers of that district.

THE WATER OF LEITH PURIFICATION SCHEME.—A meeting of the Water of Leith Purification and Sewerage Commissioners was held in the City Chambers, Edinburgh, on the 10th inst., Provost Aitken, Leith, Presiding. The clerk read a special report by Messrs. Leslie and Reid, C.E., on the completion of the works in the landward district. The report stated that according to notices the occupiers of the mills and works proceeded with all dispatch to get connexions made with the regulating tanks of the Commissioners, and the engineers were able to report that all the connexions had been completed, and that the discharges from the mills and works were now passing down the sewer. They had not yet had time to get the quantity of water discharged by the mills and works properly gauged, as it varied from hour to hour, and required a series of observations carried on for a considerable period to be able to say what might be taken as the average discharges from the mills and works into the sewer. They might say, however, that from the gauge already taken the total aggregate flows from mills and works above the special boundary would not exceed 200,000 cubic ft. per day, or 140 cubic ft. per minute. The quantity discharged from the compensation reservoirs at the present time was 1,200 ft. per minute. The quantity of water in stock at the present time in the compensation reservoirs in excess of the old capacity was 36,000,000 cubic ft. The effect of the removal of the sewage and the discharges from the paper mills and other works on the water of the river was very apparent, but the river bed was in rather a polluted condition, and the full effect of the purification works would not be obtained until the river bed had been thoroughly scoured out by successive floods. Bailie Archibald said the report was very satisfactory. They had now practically completed this great scheme of purification, and, although it had cost a little more money than was first intended, he thought it would be apparent that, considering the purity of the stream which they might expect now and the great advantage to the manufacturers on the river, from a health point of view this money would be well spent indeed. He suggested the present would be a fitting time to make an inspection of the whole works, to see the marked difference in the stream after expending about 230,000*l.* He moved accordingly. Ex-Bailie M'Lachlan seconded, and it was remitted to the Works Committee to make arrangements.

NEW WATER SUPPLY FOR MATLOCK BATH.—An additional water supply for Matlock Bath, Derbyshire, was inaugurated on the 18th inst. The engineer has been Mr. W. H. Radford, of Nottingham.

THE PROPOSED NEW HARBOUR AT KIRKCALDY.—At a special meeting of the Kirkcaldy Harbour Commissioners, held on the 22nd inst., Mr. Hall Blyth's report on the proposed new harbour for Ravenscraig was again under consideration. The report was unanimously adopted. The undertaking is estimated to cost 300,000*l.*

NORTHAMPTON SEWAGE DISPOSAL.—The Northampton Town Council have obtained a Provisional Order for acquiring further land in extension of their sewage farm at Ecton, rendered necessary by the rapid increase in the population of the town. It is to be laid out for irrigation and intermittent filtration, the Corporation preferring this method of dealing with their sewage, to the adoption of any chemical treatment. At the inquiry there appeared for the Town Council, Mr. Balfour Browne, Q.C., Mr. E. Bailey Denton, M.Inst.C.E., whose firm's report (Messrs. Bailey Denton, Son, & North) the Corporation had adopted, Mr. W. D. Gibbins, A.M.Inst.C.E., Assistant Borough Engineer, and Col. Jones, V.C., C.E.; while General Sotheby, the landowner, who opposed the Order, was represented by Mr. Rickards, Barrister-at-Law, Mr. G. Chatterton, M.Inst.C.E., and Mr. Everard, of Leicester.

STAINED GLASS AND DECORATION.

MEMORIAL WINDOW, ST. LEONARD'S CHURCH, BRIDGNORTH.—A memorial window, by Messrs. Clayton & Bell, of London, has been erected in the old parish Church of St. Leonard's, Bridgnorth, in memory of Councillor Richard C. Smith, who died February 1, 1892. The figures represent St. Alban, the first British martyr; St. Oswald, King of Northumbria; and St. Chad, Bishop of Lichfield.

MEMORIAL WINDOW, CHRIST CHURCH, WOLVERHAMPTON.—On the 11th inst. the Bishop of Lichfield (Dr. Legge) unveiled and dedicated at Wolverhampton a window which has been inserted in the east wall of the chancel of Christ Church. The window, which is to the memory of Mr. Stephen Richards, is made of stained glass representing the Crucifixion, and the artist was Mr. Windham Hughes, of Edgbaston, Birmingham.

WINDOW, ST. JUDE'S CHURCH, NOTTINGHAM.—A large stained-glass window of five lights and tracery, erected in the new chancel of St. Jude's Church, Nottingham, has just been dedicated by the Bishop of Derby (Dr. Were). The subject illustrated is the Ascension of our Lord. The window has been executed by Mr. Samuel Evans, of West Smethwick.

MEMORIAL WINDOW, ST. MARY'S CHURCH, BOSTON SPA, YORKSHIRE.—Mrs. George Field, of Boston Spa, near Tadcaster, has just placed in St. Mary's Church, Boston Spa, a baptistery window in memory of her deceased husband, Mr. George Field, and their two sons. The subject is "The Baptism of Christ," and the window has been erected by Messrs. Clayton & Bell, of London.

FOREIGN AND COLONIAL.

FRANCE.—The total product of the sale of Meissonier's works has amounted to 2,216,601 francs.——The exhibition of portraits of writers and journalists of the day will be opened on June 10 in the Georges Petit Gallery, and will close on August 15.——An exhibition of the works of Charlet will be opened on June 1 in the Durand Ruel Gallery, Rue Le Peletier, under the patronage of the Minister of Fine Arts.——At the Palais de Justice the bust of Duc, the architect, who died in 1879, has just been placed in the grand gallery adjoining the Place Dauphine. The bust was commenced by Chapu and remained unfinished on account of his death. It has been completed by some of his pupils, under the direction of M. Daumet, the architect.——The "Union Libérale des Artistes Français" opened its exhibition last week, under the central Dome of the Champ de Mars.——M. Louis de Fourcaud, art-critic, has been appointed professor of the æsthetics and history of art at the École des Beaux-Arts in place of the late M. Taine.——On May 7 there took place at the cemetery of Père Lachaise, the inauguration of the monument raised to the memory of Eugène Delaplanche, the eminent sculptor, who died about a year ago. The monument, in grey granite and white marble, is surmounted by a bronze bust of the sculptor.——The monument to Arago, behind the Paris Observatory, will be inaugurated on June 11.——The Government is about to restore or repair, at the public cost, all the monuments raised in the departments to the memory of French soldiers who fell in the war of 1870-71.——A Post and Telegraph Office is shortly to be built at Saint Nazaire.——An important competition has been started, open to all French engineers, for the best plans for a maritime canal between the Atlantic and the Mediterranean. Large sums are to be given as premiums. The plans are to be sent in on the 31st of December of the present year.——The Prefect of the Seine has proposed to the Municipal Council of Paris to authorise the erection of a monument to Emile Augier on the Place de l'Odéon.——An interesting exhibition of the works of M. Albert Aublet is announced to be held at the Georges Petit Gallery.

ANTWERP INTERNATIONAL EXHIBITION, 1894.—About a year ago a committee was formed in Antwerp for the holding of an international exhibition there in the summer of 1894. This committee succeeded in obtaining the official support and assistance of the Belgian Government for the issuing of official invitations to foreign governments to participate in the same, and at a meeting just held, to which the foreign Consuls were invited, they were informed that the necessary funds had been secured, and that the exhibition would be held at the appointed time, and that considerable foreign support was assured. A circular has now been issued stating that the exhibition will be opened on May 5, 1894, to remain open six months. The objects exhibited will be divided into sixty-six groups, the number of sections being twenty-two, of which may be mentioned fine arts, education, arts, textiles, dress, architecture, chemical industries, electricity, food, commerce, navigation, war, forestry, &c.

SWEDEN.—A company has been formed in Stockholm, with a maximum capital of 500,000 kr. for the establishment of an industrial palace in that city.——A so-called "villa" suburb is being laid out on the beautiful Djursholm estate near Stockholm, shortly to be connected with the capital by an electric railway. The chief interest attaching to the same is that several leading architects and artists intend to take up their residence here and are designing the same. Plots of land for 300,000 kr. have already been sold.——The Swedish Parliament has voted a sum of 65,000 kr. towards the new State Bank building in Hernösand.

MISCELLANEOUS.

SURVEYORSHIP, PARISH OF ST. MARY, NEWINGTON.—We understand that Mr. J. Paget Waddington, Assoc.Mem.Inst.C.E., and Chief Assistant Surveyor to the Vestry of Islington, has obtained this appointment.

BOOK SALE.—Last week Mr. Sotheby sold by auction a fine collection of books, consisting mostly of modern works, printed as "éditions de luxe," limited in number, and in costly bindings. Amongst the 1,300 lots were included the following: A. Dobson's "Hogarth," plates on Japanese paper, 1*l.*; J. E. Doyle's "Chronicle of England," designs by E. Evans, bound by Zaehnsdorf, 1864, 3*l.* 9s.; Duruy's "History of Rome and the Roman People," edited by the Rev. J. P. Mahaffy, 6 vols. in 12, 4*l.* 10s.; Pierce Egan's "Life in London," illustrated by I. R. and G. Cruikshank, in the original boards, 1822, 5*l.* 15s.; "Evenings at Haddon Hall," illustrated by G. Cattermole, 1*l.* 8s.; Fergusson's "History of Architecture," "Indian and Eastern Architecture," and "Modern Styles of Architecture," 5*l.*; J. Gould's "Birds of Australia," with supplement, 8 vols., bound in dark green morocco, by Zaehnsdorf, fo., 230*l.*; Malory's "Morte d'Arthur," reprinted from Caxton's original edition, 2 vols. on Japanese vellum paper, 4to, 10*l.*; Millet's "Livre d'Or," with two extra sets of F. Jacque's etchings, Paris, 4to, 5*l.* 5s.; W. Scrope's "Art of Deer-Stalking," and "Salmon Fishing in the Tweed," illustrated by Landseer, the author, and others, 20*l.*; W. Senior's "The Thames from Oxford to the Tower," with a duplicate set of F. S. Walker's etchings, 6*l.*; Halliwell-Phillipps' "Works of Shakespeare," in 16 vols., illustrated by F. W. Fairholt, fo., 1853-65 (one of 150 copies), 66*l.*; H. Shaw's "Dresses and Decorations of the Middle Ages," 2 vols., original edition, plates beautifully coloured, bound by Clarke & Bedford, 16*l.* 10s.; L. M. Solon's "Art of the Old English Potter," 50 etchings by the author, fo., 1*l.* 11s.; J. Stark's "Rivers of Norfolk," proof plates, Norwich, fo., 5*l.*; Sterne's "Sentimental Journey," illustrated by Leloir, New York, 4to, 16*l.*; Stirling-Maxwell's "Annals of the Artists of Spain," 5*l.* 5s.; and his "Don John of Austria," 9*l.* 10s.; and J. A. Symond's "Renaissance in Italy," 7 vols., 1880-6, 10*l.* 10s. The five days' sale realised a total of 3,427*l.*

A NEW STEAM ROAD-SCARIFIER.—In repairing macadamized roads it is very necessary, in order to obtain a good surface, that the old macadam should be well loosened. This, of course, is generally done by means of the hand-pick. The work is laborious and unpleasant, the jar on the man's arms being exceedingly trying after a short time of working; and for this reason the operation is too often inadequately performed. In order to overcome this difficulty, Messrs. Voysey & Hosack, of Higham, near Rochester, have introduced a steam scarifier, which has been tried in some districts in Kent. It has lately been in operation on one of the roads running through Wimbledon-common, where we had an opportunity of inspecting the work done and examining the machine, although it was not in work at the time of our visit. Briefly stated, the apparatus consists of a heavy cast-iron framing, attached to one of Aveling & Porter's 15-ton steam-rollers. The mechanism is actuated by a pitch chain, direct from the crank shaft of the engine. This drives a cog-wheel; another wheel being attached to the same shaft, on which works a second chain, and in this way a third chain is used which drives the scarifier itself. The latter consists of a series of cast iron discs, having recesses cast in them, and into these recesses fit a number of tines, points, or teeth, which perform the scarifying operations. There is a pair of wheels on the after part of the apparatus, and by means of a hand screw, the points can be lifted clear of the ground, so as not to disturb the roadway when the machine is simply travelling to and from its work. To judge by the length of road we saw, which was in all states of preparation, the loosening of the surface is very effectively performed by this machine. Part of the road, which had not been operated on, was in the usual state of modern macadam after a year or so of wear, that is to say, exceedingly hard and irregular. The next section had been passed once over by the machine and was completely broken up, the metal being all loose; indeed it was difficult to believe that it was not old metal newly laid. Farther along the work was advanced another stage, sufficient macaden having been spread, and the steam roller having done its work. The surface was very true, for the old depressions and granite protuberances had been all obliterated. As the roller had an area of equal looseness to work upon there was no tendency for the metal to sink deeper in one place than in another. The inventors state that the cost of this undoubtedly effective work is one-tenth that of hand labour. The machine is regulated by one man, and no smith's work is required on the operating part. This is apparent from the ease with which the tines can be replaced; it being only necessary to slack back half a dozen nuts, when the points will drop out of themselves. New ones can be replaced, and the whole be in working order again in ten minutes or less. The machine will work at a speed of from 4,000 to 5,000 square yards per day, and it is stated that a saving of 20 per cent. may be effected in the quantity of metal necessary to re-make a road, or where the sides of a road are high, repairs may be effected by means of the scarifier and rolled without the addition of new material. The ease with which the apparatus may be attached to a steam roller is also a point in its favour.

AN AIR-TIGHT WATER-CLOSET LID.—Mr. T. Bradbear, of Nechells (Birmingham), sends us the specification of a patent form of lid for water-closets for preventing the escape of any unwholesome effluvia into the house when the closet is not in use. The under side of the lid has a circular projecting rim fitting into a small circular trough in the seat filled with water; or a rim fitting into a rubber-lined trough in the same manner. The latter is the best, as the small quantity of water in the trough in the former case would be soon evaporated, and probably not be replenished. An air-tight seat is a desideratum for water-closets, however; though we do not undertake to say that this way of securing the object is really new. The patentee combines with this contrivance the provision of an outlet pipe to the open air from the interior of the basin; a system which we believe has long been in use in America.

MEETINGS.

FRIDAY, MAY 26.

Architectural Association.—(1) Election of Officers; (2) Paper by Mr. T. A. Sladdin on "The Travelling Student's Notes." 7.30 p.m.

MONDAY, MAY 29.

Surveyors' Institution.—Annual General Meeting, (1) to receive the report of the Council, and the announcement of the result of the election of officers for the ensuing year; (2) Presentation of prizes awarded to successful candidates in connexion with the recent Professional Examinations. 3 p.m.

TUESDAY, MAY 30.

Institution of Civil Engineers.—Annual General Meeting, of Corporate Members only, to receive the report of the Council, and to elect the Council and Auditors for the ensuing year. 8 p.m.

Society of Arts (Applied Art Section).—Mr. Horace Townsend on "American Silver Work." 8 p.m.

WEDNESDAY, MAY 31.

Architectural Association.—Annual Dinner, Criterion Restaurant. 7 p.m.

Surveyors' Institution.—Annual Dinner, Holborn Restaurant. 6.30 p.m.

Carpenters' Company, Carpenters' Hall (Lectures on Carpentry and Joinery).—Professor T. Roger Smith on "The Framing and Construction of Partitions, Floors, and Temporary Structures." 8 p.m.

THURSDAY, JUNE 1.

Society for the Encouragement of the Fine Arts.—Third Conversazione, at the Galleries of the Royal Institute of Painters in Water Colours, Piccadilly.

Society of Antiquaries.—8.30 p.m.

SATURDAY, JUNE 3.

Architectural Association.—Visit to the old church and chapel, the Old Manor House, &c., at Chenies, Bucks.

Edinburgh Architectural Association.—Annual Excursion, to Cupar and district.

RECENT PATENTS.

ABSTRACTS OF SPECIFICATIONS.

6,408.—CHIMNEY COWLS: *W. Waghorn.*—The object of this invention is to make of a small form, without any moveable parts, an updraught chimney cowl, so formed that the greater the horizontal pressure of wind from the exterior the greater updraught it will cause. The inventor makes an ordinary tube to fit over the present chimney top, or to be attached to the chimney stack, the tube being preferably made slightly conical, tapering to the top. At a convenient distance from the top is constructed on the outside of the tube a spiral slightly conical, converging upwards and inwards, this spiral being fixed round the tube like a large spiral screw, the spiral part being carried out and upwards above the top of the tube according to the size, generally about 18 in. to 2 ft. Strengthening pieces are attached at intervals, the end of the spiral being preferably connected to the next lower one. The spiral above the top of the tube thus forms a hollow conical spiral, so that from whatever side the wind strikes it, the current of air is directed in an upward direction through the centre hollow part of the spiral.

6,900.—VENTILATORS AND CHIMNEY COWLS: *R. R. Gibbs and E. H. Maddock.*—These ventilators are of two kinds, one for admitting, and the other for extracting air. In the former, the improvement consists in enlarging the mouth or outlet of an ordinary "Tobin" tube, and in the expanded part thus formed fitting a loose tray made up of one or more tubes of perforated zinc or other suitable material. These tubes may be round, square, or other section, the object being to so increase the surface that, whilst admitting the full quantity of air, instead of it entering all in one body, to cut it up into a number of small columns of air with the object of avoiding draught. The second and most important part of the invention is for improvements in wind ventilators for extracting air or gases from buildings, ships, soil-pipes, chimneys, &c., and consists in arranging in the head of the ventilator a series of tubes having longitudinal slits, or equivalent perforations, opening inwards towards the centre, and towards each other, one end of each tube being stopped, and the other end opening into a chamber communicating with the extracting shaft. In the central space, towards which all the slit openings converge, is formed a core or pillar of such shape

COMPETITIONS, CONTRACTS, AND PUBLIC APPOINTMENTS.

COMPETITIONS.

Nature of Work.	By whom Advertised.	Premiums.	Designs to be delivered.
*Schools, &c. at Bean and Brent	Stone School Board	.....	June 7
*Scheme for Sewerage Disposal	Monmouth U.S.A.	31*l.* 10*s.* and 21*l.*	July 1
*Public Library and Technical School	Boro of St. Helen's	100*l.* 50*l.* and 25*l.*	July 24
*New Municipal Buildings	Darlington Corp.	.....	No date

CONTRACTS.

Nature of Work or Materials.	By whom Required.	Architect, Surveyor, or Engineer.	Tenders to be delivered.
Three New Roads, Rectory-road Estate, Ipswich	Ipswich and Suffolk Freehold Land Soc.	H. A. Wright	May 30
Dwelling-house, Loughor, Llanelly	Rev. D. Jones	M. Arnold	do.
Conservative Club, Bradford Moor	.....	G. C. Gamble	do.
Well Sinking, Counterthorpe	Leicester Union	*Official*	do.
*Tar-paving Works, &c.	Bromley Local Board	do.	do.
*Hire of Horses	St. Saviour's B. of W.	do.	do.
Macadam	Widnes Corporation	do.	May 31
Flagging Kerbs, &c.	do.	do.	do.
Additions, &c. to Old Municipal Offices	Portsmouth Corp.	do.	do.
Lime (250 tons)	Guildford Gas, &c. Co.	do.	do.
Railway Stores	East Indian Ry. Co.	do.	do.
*Portland Cement	Hove Commrs.	do.	do.
Tar-paving Works	Sutton (Surrey) L. B.	A. D. Greatorex	do.
Additions, &c. to Science and Art School	Birkenhead Corp.	C. Aldridge	do.
*Drainage Works	Fulham Vestry	J. P. Norrington	do.
Alterations to School Buildings, Coten End	Warwick School Board	F. H. Moore	do.
House, Eastfield, Peterborough	Edwd. Leigh	Jas. Ruddle	do.
Farmhouse, Langley Hall, Fence Houses	Earl of Durham	J. Gibson Cowe	do.
Sewering, Kerbing, &c. Wilson and other Roads	Handsworth Loc. Bd.	E. Kenworthy	do.
Making-up Prospect, &c. Roads	Woodford Local Board	J. D. Hooper	do.
Additions to School Buildings, Newcomin-road	Dartmouth Union	E. H. Back	June 1
Road and Drainage Works, Weelsby, Grimsby	Rt. Hon. E. Heneage, M.P.	Wm. Waller	do.
*Road Materials	Richmond(Surrey)T.C.	E. J. Lovegrove	do.
Widening and Reconstructing Road, Pentyrch, Llandaff	.....	.....	do.
Six Store-rooms, Market Hall	Burton-on Trent Corp.	Jas. Holden	do.
Waterworks	Dundee Water Com.	J. E. Swindlehurst	do.
Alterations of Parish Church, Foveran, N.B.	.....	Geo. Baxter	do.
Assembly Rooms, Burgh-by-Sands	.....	W. Ruxton	do.
Gas and Water Pipes (500 yds.)	Ulverston Town Coun.	Geo. Armstrong	do.
Cast-iron Socket Pipes, &c.	Salford Corporation	Jno. Swann	do.
Street Works	Duns (N.B.) Burgh Commrs.	*Official*	do.
*Hot-water Heating Apparatus	Fulham Union	do.	do.
Stores	Stretford (Manchester) Gas Co.	do.	do.
Street Improvements	Ilkley Local Board	do.	June 2
Two Dwelling-houses, Windermere	T. Christopherson	M. Hainsworth, Jun.	do.
School Buildings, Clydach, Glam.	Rhyndwyclydach S. B.	Robt. Walker	do.
Public Conveniences	Bournemouth Twn C.	Rees Llewellyn	June 3
Coach House, &c. Willaston House, Harrogate	Joseph Benn	F. W. Lacey	do.
*Water Tower	Wisbech Water Co.	Jno. Drake	do.
*Wrought-iron Tank with Girders	do.	E. Easton & Co.	do.
Flint Road Metal	Seaford (Sussex) L.B.	do.	do.
Forming and Making Roads, Waverley Estate	Farnham Local Board	*Official*	do.
Additions to Laundry	Christchurch Union	do.	June 5
School Buildings, Stanningley, Leeds	.....	do.	do.
Re-construction of Tramways	Greenock Police Board	Walter Hanstock	do.
Additional Block at Industrial School, Lichfield	Staffs County Council	A. J. Turnbull	do.
Levelling, Paving, &c. Jacob-street	Batley Town Council	J. T. Meredith	do.
		H. Dearsden	do.

CONTRACTS—*Continued.*

Nature of Work or Materials.	By whom Required.	Architect, Surveyor, or Engineer.	Tenders to be delivered.
*Drainage Works, Restoration of Land, &c.	Sandgate Local Board	Baldwin Latham	do.
*Coal and Coke, Repairs to Roads	Boro of Croydon	*Official*	June 6
Sewers and Diversion of Water Course, Platt Bridge, Wigan	Ince Local Board	do.	do.
Sewering Oldham-road, &c.	Middleton (Lancs.) Corporation	do.	do.
Irish Limestone	Glasgow Corporation	do.	do.
Laundry Buildings, Carlow Asylum	Commissioners	do.	June 7
*Tar Paving	Southend-on-Sea Corp.	C. T. Copley	do.
*Sewerage Works	Orsett R.S.A.	C. & F. H. Jones	do.
*Roadmaking, &c. Works	Chiswick Local Board	A. Ramsden	do.
Reservoir, Peak Forest Station	Buxton Lime Firms Co. Ltd.	.....	do.
Two Semi-detached Residences, Havera Bank, Sedbergh	Mrs. & Miss Handley	Stephen Shaw	June 8
Additions, &c. to Residences, Fairfield, Sedbergh	T. Dover	do.	do.
Electric Light Mains, &c.	St. John, Hampstead, Vestry	A. H. Preece	do.
*Shop and Store, &c. Devonshire-place	Brighton Council	F. J. C. May	June 9
*Wood and Stone Working Machinery	London CountyCouncil	*Official*	do.
*Decorating Chapel, Horncastle	The Trustees	do.	June 12
Sewerage Work, Llandrindod	Builth R.S.A.	R. L. Bamford	do.
School Buildings, near Halifax	Warley School Board	C. F. L. Horsfall & Son	do.
New Avenue, Dundalk	Earl of Roden	R. P. T. Logan	do.
*Painting Works, &c. at Schools	Sch. Bd. for London	*Official*	June 12
Brick Sewer, &c.	Swansea Town Council	do.	do.
*Sewerage Works	Swansea T.C.	do.	do.
*Road Works	Hanwell Local Board	S. Barnes	do.
*Waterworks and New Road	Bideford U.S.A.	Baldwin Latham	do.
*Two Pavilions at Hospital	St. Helens Health Committee	Geo. J. C. Broom	June 14
*York Stone Paving	Rochester, Chatham, and Stroud Gaslight Company	*Official*	do.
*Casual Wards, Gt. Guildford-street, S.E.	St. Saviour's Union	H. Jarvis & Son	June 15
*Isolation Hospital	Moulsford Lunatic Asylum	G. T. Hine	do.
Additions, &c. to School, Hoo St. Werburgh, Rochester	.....	John Drake	June 17
*Stabling, Underground Convenience, Wood, &c. Paving Works, &c.	Westminster Vestry	G. W. R. Wheeler	June 19
*Drainage Works	East Molesey Loc. Bd.	J. C. Melliss	June 21
Pipe Sewers	Market Harborough R.S.A.	Mr. Biggs	do.
*Two Pumping Engines, &c.	Leicester Corporation	J. B. Everard	June 23
Extensive Additions to "New Inn," Pontypridd	.....	E. M. Bruce Vaughan	June 24
School Chapel, Rochdale	.....	E. Wood	No date
Tramways	Coventry and District Tramways Co.	*Official*	do.
Cast-iron Socket, &c. Pipes (1,620 yds.)	Great Wigston Gas Co.	J. A. Harris	do.
Villa Residence, Wigan-lane, Wigan	.....	W.E.VernonCrompton	do.
Five Houses, Stabling, &c. Knaresborough	J. Brazier	.....	do.
Flint Wall, &c. Enlargement of Churchyard, Dunsden, Reading	C. Reading	.....	do.

PUBLIC APPOINTMENTS.

Nature of Appointment.	By whom Advertised.	Salary.	Applications to be in.
*Clerk of Works	Willesden Local Bd.	3*l.* 3*s.*	May 31
Clerk of Works	Eccles Corporation	3*l.* per week	June 1
*Surveyor	Newburn District L.B.	150*l.*	do.
*Sanitary Inspector	Westminster Vestry	130*l.*	June
*Surveyorship, Ireland, Surveyor and Inspector of Nuisances	Civil Service Commis.	.....	June 29
	Woodford Local Board	.....	No date

Those marked with an Asterisk (*) are advertised in this number. *Competitions, p.* iv. *Contracts pp.* iv., vi., viii, ix., *and* xxii. *Public Appointments, p.* xx.

and size that its exterior surfaces form narrow passages past the slit openings.

8,902.—DRAIN-TESTING APPARATUS: *H. E. Burnet and W. E. Groom.*—This specification refers to an improved drain and soil-pipe testing apparatus, consisting of a case or cases containing combustible smoke and heat-producing material in combination, and acting in conjunction with, cases containing any suitable strong smell-producing material, such as assafœtida, oil of peppermint, &c., this latter being expelled by the heat produced from the combustible material when ignited.

9,847.—FACING BRICKS: *W. John.*—This invention relates to facing bricks or tiles of porcelain or pottery ware. By the use of these bricks or tiles it is claimed that in wall coverings no mortar or cement joints are visible externally, and that the individual bricks or tiles are united with the plaster upon the wall with a firmness which has been hitherto unattainable. Instead of the facing bricks being made as heretofore in the form of regular plates, they are made hollow, somewhat in the form of tiles partially open at the back, their side faces being made oblique for the purpose of affording a secure hold for the layer of mortar, plaster, or cement between them, or their front surfaces can be made to extend beyond the side faces either in combination with oblique side faces or not.

6,375.—PIPES: *W. Assiter.*—This invention consists of a clip or band for the more expeditiously and sightly fixing of lead pipes to walls, &c., but may be used for other purposes. As applied to lead pipes with wiped metal joints in place of the ordinary "tacks," the clip is made of lead, or other suitable material, plain or ornamental, and of such a form as to endorse the wiped joint, following its shape so as to support the pipe when the clip is fixed by the wings formed on to it to the wall. The clip may be made to open for the purpose of enclosing the pipe, or may be made fixed to the pipe.

NEW APPLICATIONS FOR LETTERS PATENT.

MAY 8.—9,131, J. Kunz and A. Hofgraff, Portable building.—9,146, J. Clark and J. Shaw, Automatic Fastener or Protector for Windows, Casements, &c.—9,190, A. Weiss, Devices for Adjusting the Opening of Windows.—9,194, W. Hyatt, Manufacture of Paint.—9,196, P. Fowler, Fireplaces.—9,201, S. Chitty, Ventilators.—9,203, R. Allen, Clamping Apparatus for Laying Floors, &c.—9,208, E. Sheldon, Levelling.—9,209, R. Bennett, Square Drill or Square-boring Device.

MAY 9.—9,226, W. Rouse and H. Hill, Nails.—9,251, P. Somervail, Struts and Ties for Iron and Steel Bridges, Roofs, and Structural Works.—9,259, E. Morgan, Fire-grates.—9,289, W. Hargreaves, Fireproof Stages for Theatres and Other Buildings.—9,293, H. Lake, Manufacture of Pigments or Paints.—9,311, K. Schulz and A. Kabile, Roofing Tiles.

MAY 10.—9,332, R. Kerr & Sons and others, Machines for Forming Dovetails in Woodwork.—9,333, J. Levick, Folding Lavatories.—9,351, J. Hussey and S. Diplock, Syphon Cistern.—9,364, H. Winks, Compound Metal and Indiarubber Pipe to Prevent Bursting from Frost.—9,363, W. Tuffee, Inspection and Cleaning Branch Chamber for Junctions of Soil and Rain-Water Pipes with Drains.—9,381, W. Crookes, Glazing Bricks.—9,383, S. Lundy and C. Knight, Machine for Measuring Wall Paper.

MAY 11.—9,417, W. Lane and H. Chamberlain, Securing Door and other Knobs to their Spindles.—9,434, W. Caldwell, Ventilation of Buildings.—9,437, J. and H. Hartley, Gilding the Surfaces of Wood, &c.

MAY 12.—9,482, H. Johnson, Ventilators.—9,493, A. Wilson and S. Broadbank, Composition for the Protection of Stonework, &c., against Damp.—9,494, R. Warwick, Shaping and Moulding Bricks for Architectural Purposes, &c.—9,497, G. Burridge and J. Farningham, T-Squares.—9,539, G. Bidder, Pipes for the Conveyance of Water, &c., to Prevent Bursting from Frost.—9,542, J. Day, Water-closets.

MAY 13.—9,573, J. Sammons, Roofing Tiles.—9,575, J. Towry, Garden Frames, Greenhouses, Sashlights, &c.—9,579, J. Shepherd, Lifts.—9,629. J. Chappell, Fireproof Floor Structures.—9,651, J. Lenert, Cowl for Chimney and Ventilating Shaft Tops.

PROVISIONAL SPECIFICATIONS ACCEPTED.

5,380, H. Godward, The Anti-down-draught Smoke-Cure.—5,396, R. Peffers, Patent Jointing-eye on Oval and Round Sanitary Glazed Fire-clay Drain-Pipes.—5,588, W. Cook, Window Sash-fasteners.—6,227, T. Fife, Pipe Joint.—6,308, J. Johnston, Window Sash-holder and Fastener.—6,726, W. Reynor, Prevention of Fracture of House and other Drain-pipes.—6,791, P. Willis, Dog for Saw-mills.—6,794, W. Wagstaffe, Chimney Pots and Ventilators.—7,090, J. Thomlinson, Fireproof Floors and Ceilings.—7,315, E. Penn, Window Fasteners.—7,952, H. Taylor, Ratchet Brace.—8,211, J. Riddiough, Blades or Saws for Sawing or Cutting Stone.—8,212, J. Sellars, Production of Facing Materials for Building and other Surfaces and Surfaces generally.—8,361, G. Restall, Nail.—8,672, M. Harczyk, Tiles for Stoves, &c.

COMPLETE SPECIFICATIONS ACCEPTED.

(Open to Opposition for Two Months.)

11,732, W. Neilson, Bolts for Doors, Windows, &c.—13,489, J. Robinson, Swinging Door-springs and parts connected therewith.—4,797, C. Rice, Portable Door-stop for Preventing Doors being Shut.—5,975, R. Cowl, Locking Gear for Window-sashes.—7,045, E. Wethered, Lock Furniture.

SOME RECENT SALES OF PROPERTY

ESTATE EXCHANGE REPORT.

MAY 12.—By *A. J. F. Gibbons* (at Walthamstow): 28 29, Gamuel-rd., Walthamstow, f., 320*l.*

MAY 15.—By *W. P. Goulding:* 167, 169, Stanstead-rd., Forest Hill, f., r. 52*l.*, 82*o.*; f.g.r. of 8*l.*, Stanstead-rd., reversion in 50 yrs., 270*l.*; 105, 109, West End Lane, Hampstead, u.t. 92 yrs., g.r. 23*l.* 2*s.*, r. 130*l.*, 1,200*l.*—By *Woods & Snelling:* 57, 59, 61, Brabazon-st., Bromley-by-Bow, u.t. 69 yrs., g.r. 9*l.*, 300*l.*—By *R. A. Notley:* F.g.r. of 70*l.*, Theobald's-rd., Holborn, reversion in 99 yrs., 1,960*l.*; f.g.r. of 49*l.*, Grange-rd., Plaistow, ditto in 83 yrs., 1,120*l.*—By *Messrs. Cronk:* "Ashgrove," Knockholt, Kent, and 18a. 3r. 2 1p., f., 3,150*l.*—By *Fuller, Moon, & Fuller:* 68, Parson's Mead, Croydon, f., 510*l.*; 68, London-rd., u.t. 49 yrs., g.r. 33*l.*; and a plot of f. land adjoining, 3,800*l.*—By *Seagrave, Browett, & Taylor:* 178, 180, St. James'-rd., Old Kent-rd., u.t. 11 yrs., g.r. 6*l.*, r. 36*l.*, 23*5l.*; Eight f. cottages, near Godalming, 500*l.*; l.g.r. of 12*l.*, Southwark-pk.-rd., u.t. 11 yrs., 95*l.*; 188, 190, 192, Southwark-pk.-rd., u.t. 11 yrs., no g.r. 570*l.*; 148 to 176 (even), St. James'-rd., Bermondsey, u.t. 11 yrs., g.r. 30*l.*, 1,080*l.*—By *Rogers, Chapman, & Thomas:* l.g.r. of 106*l.* 16*s.*, Cambridge-ter., Pimlico, u.t. 31 yrs., no g r., 1,703*l.*; l.g.r.

of 58*l.*, Johnson's-pl., u.t. 31 yrs., g.r. 1s. 6d., 881*l.*; i.g.r. of 80*l.*, Rutland-st., u.t. 31 yrs., g.r. 4s., 1,222*l.*; i.g.r. of 78*l.*, u.t. 31 yrs., no g.r., 1,170*l.*; i.g.r. of 59*l.*, Cumberland-st., u.t. 34 yrs., g.r. 6s., reversion for 5¾ yrs., 1,016*l.*; i.g.r. of 56*l.*, u.t. 40 yrs., g.r. 7s., 812*l.*; i.g.r. of 67*l.*, Sussex-st., u.t. 39 yrs., g.r. 2*l.* 10s., reversion for 1¾ yrs., 1,145*l.*; i.g.r. of 165*l.*, Winchester-st., u.t. 34 yrs., g.r. 9*l.* 10s., reversion for 5¾ yrs., 2,565*l.*; and, Torrington Mews, Gordon-sq., u.t. 30 yrs., g.r. 2*l.*, r. 25*l.*, 205*l.*; i.g.r. of 14*l.*, Torrington Mews, u.t. 30 yrs., g.r. 4*l.*, reversion for 3 yrs., 125*l.*—By *Hampton & Sons:* "Whitelock's Farm," Warfield, Berks, and 38 a. 2 r. 28 p., r. 50*l.*, 1,200*l.*

MAY 16.—By *Chesterton & Sons:* 18, Airlie Gardens, Kensington, u.t. 87 yrs., g.r. 40*l.*, 3,000*l.*; i.g.r. of 21*l.*, Somerford-st., Bethnal Green, u.t. 9 yrs., reversion for 3 yrs., 105*l.*; i.g.r. of 113*l.*, Euston-bldgs., Euston-rd., u.t. 14 yrs., g.r. 28*l.*, 430*l.*—By *Foster, Howell, & Co.:* 52, Bessborough-st., Pimlico, u.t. 41 yrs., g.r. 11*l.*, 430*l.*—By *Dixon & Co.:* 26, Faraday-rd., Notting Hill, u.t. 83 yrs., g.r. 7*l.* 10s., 300*l.*—By *B. Brown:* 2 and 4, Spray's-st., Woolwich, u.t. 13 yrs., g.r. 24*l.*, r. 68*l.*, 160*l.*; 137, West Ferry-rd., Millwall, u.t. 17 yrs., g.r. 2*l.* 10s., r. 30*l.*, 295*l.*—By *C. F. Dowsett:* 7, Crossfield-rd., Hampstead, u.t. 85 yrs., g.r. 5*l.*, 750*l.*—By *F. Jolly & Co.:* 131, Green-st., Bethnal Green, f., r. 40*l.*, 515*l.*; 114, Barking-rd., Plaistow, f., 530*l.*; 31 to 37 (odd), Duncan-st., Hackney, u.t. 45 yrs., g.r. 10*l.*, 265*l.*—By *Humbert, Son, & Flint:* The f. residence, "Nutwood," Chislehurst, r. 55*l.*, 750*l.*—By *Thurgood & Martin:* 15 and 17, James-st., Whitechapel, f., 1,005*l.*; 1 to 7, Elizabeth-cottages, Loughton, f., 600*l.*; 102 and 102A, Weston-st., Southwark, u.t. 15 yrs., g.r. 4*l.* 10s., 125*l.*; 29 and 30, Winslade-rd., Clapton, u.t. 52 yrs., g.r. 8*l.*, 350*l.*; "Lordlands," Laurie-pk.-gardens, Sydenham, f., 3,600*l.*; "Cheriton," The Downs-rd., Epsom, f., r. 70*l.*, 1,130*l.*; a block of f. building land, Salisbury-rd., Barnet, 510*l.*; 6, Salisbury-rd., f., r. 30*l.*, 400*l.*; 23, Lansdowne-gardens, Clapham, u.t. 49 yrs., g.r. 7*l.*, 455*l.*; enclosures of land, 4 a. 3 r. 29 p., Ditton, Surrey, f., 1,860*l.*

MAY 17.—By *D. J. Chattell:* f.g.r. of 24*l.* 10s., Woodlands-pl., Bermondsey, reversion in 34 yrs., 775*l.*—By *Stokes & Pindar:* 27, Richmond Gardens, Shepherd's Bush, u.t. 70 yrs., g.r. 9*l.*, r. 52*l.*, 260*l.*—By *H. Griffin:* 133, Bridge-rd. West, Battersea, f., r. 27*l.*, 350*l.*—By *Rushworth & Stevens:* 15, Drayton Gardens, Kensington, f., area 8,650 ft., 2,210*l.*; "Asby Lodge," Carlton-rd., Putney, u.t. 71 yrs., g.r. 70*l.*, 2,540*l.*—By *D. Young:* 156, Ifield-rd., Earl's Court, f., r. 79*l.* 6s., 480*l.*; 72, Ifield-rd., u.t. 73 yrs., g.r. 7*l.* 10s., r. 81*l.* 18s., 300*l.*; 116, Lorrimore-rd., Newington, u.t. 57 yrs., g.r. 4*l.* 10s., r. 30*l.*; 290*l.*; 43 to 49 (odd), Sidney-rd., Stockwell, u.t. 46 yrs., g.r. 18*l.*, r. 128*l.*, 990*l.*; 55, Sarsfield-rd., Balham, u.t. 85 yrs., g.r. 7*l.* 10s., r. 34*l.*, 360*l.*—By *P. Matthews & Matthews:* f.g.r. of 12*l.*, Whiston-st., Haggerston, reversion in 43 yrs., 400*l.*; 26, 28, Church-rd., f. and c., r. 70*l.*, 76*l.*; a plot of f. land, Mackintosh Lane, 50*l.*; 3, Grove-rd., Wanstead, f., r. 85*l.*, 900*l.*; 1 to 8, Hall-rd., u.t. 75 yrs., g.r. 15*l.*, 350*l.*

MAY 18.—By *J. Lees & Burchell:* 11, Alexandra Villas, Finsbury-pk., u.t. 69 yrs., g.r. 12*l.* 10s., r. 75*l.*, 580*l.*—By *C. P. Whiteley:* I.g.r. of 48*l.*, Walpole-rd., New Cross, u.t. 64 yrs., g.r. 1*l.* 2s., 820*l.*; i.g.r. of 27*l.*, Achilles-st., u.t. 64 yrs., g.r. 15s., 442*l.*—By *Rogers, Chapman, & Co.:* 94, Denbigh-st., Pimlico, u.t. 37 yrs., g.r. 8*l.*, r. 60*l.*, 600*l.*—By *Eastman Bros.:* 38 to 46 (even), Wellington-rd., Stoke Newington, u.t. 17 yrs., g.r. 12*l.*, r. 140*l.*, 500*l.*; 77 to 83 (odd), Wellington-rd., u.t. 18 yrs., g.r. 12*l.*, r. 108*l.*, 515*l.*; 29, Kemble-rd., Forest Hill, u.t. 83 yrs., g.r. 5*l.* 10s., r. 30*l.*, 225*l.*—By *Fuller, Horsey, Sons, & Cassell:* 10, Caroline-st., Camden Town, u.t. 46 yrs., g.r. 2*l.*, 260*l.*; 24, Caroline-st., u.t. 46 yrs., g.r. 2*l.*, 285*l.*—By *D. Watney & Sons:* 55, Upper Tulse Hill, Brixton, f., 1,050*l.*; No. 183, Maida Vale, u.t. 42 yrs., g.r. 18*l.*, 850*l.*; a plot of f. land, Headstone-rd., Harrow, 47*l.*—By *Stimson & Sons:* No. 408, Old Kent-rd., u.t. 34 yrs., g.r. 8*l.*, r. 45*l.*, 400*l.*; 52 to 60 (even), Leo-st., u.t. 47 yrs., g.r. 30*l.*, 425*l.* 392, Jamaica-st., Bermondsey, u.t. 49 yrs., g.r. 7*l.*, r. 50*l.*, 480*l.*; 64, Asylum-rd., Peckham, u.t. 41 yrs., g.r. 7*l.*, 220*l.*; 31 to 55 (odd), Sunwell-st., u.t. 72 yrs., g.r. 51*l.* 10s., 1,170*l.*; f.g.r. of 10*l.*, Effra Parade, Brixton, reversion in 69 yrs., 24*l.*; freehold business premises, Foots Cray, Kent; and plot of land, r. 50*l.*, 840*l.*—By *W. T. & C. Harwood:* The lease of 62, 64, 66, Tonbridge-st., Euston-rd., 350*l.*—By *Newbon & Co.:* C plot of land, Shepherd's-lane, Homerton, 335*l.*; 106, Drayton-pk., Holloway, u.t. 83 yrs., g.r. 8*l.*, r. 38*l.*, 345*l.*; 8, Cantlowes-rd., Camden Town, u.t. 57 yrs., g.r. 7*l.*, r. 45*l.*, 405*l.*; 9, 16, 17, Cantlowes-rd., u.t. 57 yrs., g.r. 23*l.*, r. 135*l.*, 1,010*l.*; 18, 19, Cantlowes-rd., u.t. 57 yrs., g.r. 16*l.*, r. 87*l.*, 695*l.*; 81, 85, 87, St. Paul's-rd., u.t. 57 yrs., g.r. 18*l.*, r. 129*l.*, 975*l.*; 65, Thornhill-sq., Islington, u.t. 52 yrs., g.r. 7*l.*, r. 56*l.*, 540*l.*; 3, Canonbury Grove, u.t. 26 yrs., g.r. 7*l.*, r. 38*l.*, 225*l.*; 27, Canonbury Villas, u.t. 26 yrs., g.r. 8*l.*, r. 48*l.*, 250*l.*; 240, 242, New North-rd., u.t. 25 yrs., g.r. 7*l.* 16s., r. 60*l.*, 325*l.*; 9, 10, Anning-st., Shoreditch, f., r. 60*l.*, 1,100*l.*—By *H. J. Bliss & Sons:* Six plots of f. land, Woodford, 180*l.*; 21, 23, 25, Cullum-st., Stratford, u.t. 83 yrs., g.r. 13*l.*, 280*l.*; Nos. 66, 68, Old Kent-rd., u.t. 27 yrs., g.r. 95*l.*, r. 175*l.*, 460*l.*; 34, 36, North-st., King's Cross, u.t. 41 yrs., g.r. 16*l.*, r. 80*l.*, 615*l.*; 9, Manor-rd., Stamford Hill, u.t. 87 yrs., g.r. 5*l.* 10s., r. 40*l.*, 420*l.*; 31, 33, 35, Odessa-rd., Forest Gate, f., 465*l.*; 46, 50, Stracey-rd., u.t. 88 yrs., g.r. 6*l.*, 285*l.*

MAY 19.—By *A. Blackford:* "The Artillery Cement Works," Dartford, Kent, area 6 acres with plant, &c., u.t. 93 yrs., r. 230*l.*, 6,350*l.*; 34, 36, 38, Wortley-rd., Croydon, f., 350*l.*—By *Rumball & Edwards:* 25, 27, Lamton-rd., Hornsey, u.t. 90 yrs., g.r. 6*l.* 5s., 580*l.*—By *C. & H. White:* 52, Rochester-row, Westminster, f., 875*l.*; 6, 7, Gloucester-st., Lambeth, u.t. 61 yrs., g.r. 6*l.*, 575*l.*; 4, Holland-st., Clapham, u.t. 6 yrs., g.r. 10*l.*, 65*l.*; 3, 4, Tyneham-rd., u.t. 72 yrs., g.r. 10*l.*, 365*l.*; 3, 4, Pepper-alley, Putney, f., 350*l.*—By *Nokes & Nokes:* 16, Spencer-rd., Hornsey, f., r. 45*l.*, 620*l.*; 70, 72, and 74, Judd-st., St. Pancras, u.t. 13¾ yrs., 330*l.*; 5, Cecile-pk., Crouch Hill, u.t. 95 yrs., g.r. 12*l.* 12s., 825*l.*; 65, 67, 69, 73, 75, Gaisford-st., Kentish Town, u.t. 56 yrs., g.r. 45*l.*, 1,785*l.*; 1, Peckwater-st., u.t. 56 yrs., g.r. 5*l.*, r. 24*l.*, 190*l.*—By *Ball, Norris, & Hadley:* 241, 243, 245, Oxford-st., f., r. 545*l.*, 16,300*l.*; 103, Glengall-rd., Kilburn, f., r. 33*l.*, 410*l.*

[*Contractions used in these Lists.*—F.g.r. for freehold ground-rent; i.g.r. for leasehold ground-rent; i.g.r. for improved ground-rent; g.r. for ground rent; r. for rent; f. for freehold; c. for copyhold; l. for leasehold; e.r. for estimated rental; u.t. for unexpired term; p.a. for per annum; yrs. for years; st. for street; rd. for road; sq. for square; pl. for place; ter. for terrace; cres. for crescent; yd. for yard, &c.]

PRICES CURRENT OF MATERIALS.

TIMBER.

Greenheart, B.G.	ton	9/0/0	0/0/0
Teak, E.I. .. load		9/0/0	15/0/0
Sequoia, U.S.ft.cu.		2/3	2/6
Ash, Canada load		2/15/0	4/5/0
Birch, do.		2/15/0	3/15/0
Elm, do.		3/15/0	4/15/0
Fir, Dantsic, &c.		2/10/0	3/5/0
Oak, do.		3/5/0	5/10/0
Canada		5/10/0	7/0/0
Pine, Canada red		2/15/0	3/15/0
Do. Yellow		2/10/0	4/10/0
Lath, D'ntsic, fath		4/10/0	5/10/0
St. Petersburg..		5/0/0	6/10/0
Deals, Finland 2nd & 1st std	100	7/0/0	9/10/0
Do. 4th & 3rd ..		6/10/0	7/0/0
Do. Riga		6/10/0	8/0/0
St. Petersburg, 1st yellow		10/0/0	14/0/0
Do. 2nd yellow..		8/0/0	9/0/0
Do. white		8/0/0	10/0/0
Swedish		7/10/0	16/0/0
White Sea		8/0/0	16/10/0
Canada, Pine 1st		21/0/0	28/10/0
Do. do. 2nd		16/0/0	17/10/0
Do. do. 3rd &c.		7/10/0	10/5/0
Do. Spruce, 1st		8/10/0	11/0/0
Do. do. 3rd & 2nd		6/10/0	8/0/0
New Brunswick		6/10/0	7/10/0
Battens, all kinds		3/0/0	15/0/0
Flooring boards, sq., 1 in. prep. 1st		0/9/6	0/16/6
Do. 2nd		0/8/0	0/12/0
Other qualities—		0/4/6	0/7/6
Cedar, Cuba ..ft.		/4	/4½
Honduras, ..&c		/4	/4½
Mahogany, Cuba		/4	/6½
St. Domingo, cargo av.		/4	1/6
Mexican do. do.		/3½	/4½
Tobasco do. do.		/3½	/6½
Honduras do. ..		/4½	/6
Box, Turkey	ton	4/0/0	13/0/0
Rose, Rio		9/0/0	20/0/0
Bahia		8/0/0	18/0/0
Satin, St. Domingo .....ft.		0/0/6	0/1/3
Porto Rico.....		0/0/7	0/1/6

TIMBER (*continued*).

Walnut, Italian ..		0/0/3½	0/0/7

METALS.

Iron—Pig, in Scotland .....ton		2/0/5	0/0/0
Bar, Welsh, in London		5/17/6	6/0/0
Do. do. at works in Wales.....		5/7/6	5/10/0
Do. Staffordshire, in London		6/0/0	6/10/0
COPPER—British, cake and ingot		46/15/0	47/5/0
Best selected ..		48/5/0	48/15/0
Sheets, strong ..		55/0/0	56/0/0
Chili, bars		43/10/0	43/17/6
YELLOWMETAL	lb	0/0/4¾	0/0/5
LEAD—Pig, Spanish.....ton		9/10/0	10/0/0
English com. brands		9/15/0	0/0/0
Sheet, English, 6 lbs. per sq. ft. and upwards....		11/0/0	0/0/0
Pipe.....		11/10/0	0/0/0
ZINC—English sheet.....ton		22/0/0	0/0/0
Vieille Montagne		22/10/0	0/0/0
TIN—Straits.....		88/2/6	88/12/6
Australian		88/12/6	89/2/6
English Ingots..		93/0/0	93/10/0
Banca		91/10/0	91/15/0
Billiton		91/0/0	91/10/0

OILS.

Linseed .....ton		20/2/6	20/5/0
Cocoanut, Cochin		29/0/0	29/5/0
Do. Ceylon		27/5/0	27/10/0
Palm, Lagos.....		28/0/0	0/0/0
Rapeseed, English pale		25/15/0	26/0/0
Do. brown		24/10/0	0/0/0
Cottonseed ref....		23/10/0	0/0/0
Oleine.....		22/0/0	24/0/0
Lubricating, U.S.		4/0/0	5/0/0
Do. refined		5/10/0	12/0/0
TAR—Stockholm	barrel	0/18/6	0/0/0
Archangel.....		0/12/6	0/0/0

TENDERS.

[Communications for insertion under this heading should be addressed to "The Editor," and must reach us *not later than* 10 *a.m. on Thursdays.*]

ACTON (Middlesex).—For the erection of "The Laborer's Friend," Acton, W. Mr. Edward Monson, jun., architect, Acton Vale, W.:—

S. & W. Pattinson	£3,300	T. Nye	£2,713
Foord & Sons	3,030	G. Lyford	2,680
G. Hooper	2,987	Dorey & Co., Brentford*	2,500
Soole & Son	2,725		

* Accepted.

ABERGWYNFI (South Wales).—For erecting new church at Abergwynfi, South Wales. Messrs. Halliday & Anderson, architects, Cardiff:—

Jenkins & Son	£2,800	Newby & Co.	£2,529
Stephens, Bastow, & Co...	2,713	Hatherly & Carr	2,503
Jones Bros.	2,611	Morgan	2,249
Gaylard, Bridgend*	2,590	Berridge	1,820

* Accepted.

BANFF.—Accepted for the erection of distillery, warehouse, manager's house, &c., Knock, for the Distillers' Company, Limited. Messrs. Gordon & McBey, architects, Elgin:

Distillery.

Builders—R. & J. Mitchell, Huntly.....	£990	0	0
Carpenters—G. & R. Cameron, Keith.....	460	0	0
Slater—A. Strachan, Keith	136	9	0
Plumber—John Wilson, Huntly.....	181	0	0
Plasterer—G. McKay, Keith	59	19	0
Plasterer—J. Lawrence, Keith	130	0	0
Iron-Founders—Jas. Johnston & Co., Elgin ...	375	0	0

Manager's House, &c.

Builder—J. Stewart, Keith	£498	0	0
Carpenter—T. G. Archibald, Huntly	241	0	0
Slater—John Hutcheson, Banff	£30 6 0	59	2
Slater—Alex. Strachan, Keith..	28 16 0		
Plumber—John Wilson, Huntly.....	84	10	0
Plasterer—George McKay, Keith	87	8	0

Warehouse.

Builder—A. Barclay, Keith.....	£149	17	0
Carpenters—G. & R. Cameron, Keith.....	191	0	0
Plumber—John Wilson, Huntly.....	20	2	0

BIRMINGHAM.—Accepted for the erection of a residence at Washwood Heath. Mr. H. Hugh Allen, architect, St. Oswald's-road, Small Heath:—
T. E. Edmunds..... £460 0 0

BISHAM-ON-THAMES.—For the erection of stable buildings and entrance lodge for Mr. Percival Harter. Messrs. Kidner & Berry, architects, 23, Old Broad-street, London, E.C.:—

Webster & Cannon	£3,098	Y. J. Lovell.....	£2,734
Silver & Son	3,059	W. Watson.....	2,690
Lawrance & Son	2,978	S. J. Scott (accepted.) ..	2,663

BLACKBURN.—Accepted at schedule of prices for the erection of stone and retaining walls adjoining the river Hyndburn, for the Rishton Local Board. Mr. J. I. Helm, Engineer, Local Board Offices, Rishton, near Blackburn:—
Fence Wall.—W. Holden, Edenfield, near Bury.
Retaining Wall.—Ab. Broadley, Clayton-le-Moors.

BOWES PARK (Wood Green, N.).—For the completion of three houses, Nos. 7, 8, and 9, Bowes-terrace, Marlborough-road, for the National Land Corporation, Limited. Messrs. Pooley & Follett, architects, 21, John-street, Adelphi, W.C.:—

Edward Hughes £239	0 0	Alfred Wood, Bowes	
George Spicer.....	228 10 0	Park, N.*	£209 6 0
Reuben Hill.....	222 10 0		

* Accepted subject to modification.

BURSLEM.—For works in the enlargement of offices, &c., for the Burslem School Board. Mr. A. R. Wood, architect, Tunstall:—

W. Cooke, ...	£857	W. Grant, Burslem *	£799
R. C. Elsby.....	800		

* Accepted.

CARBIS BAY (Cornwall).—For the erection of a hotel for the Carbis Bay Hotel Company, Limited. Mr. Silvanus Trevail, architect, Truro:—

S. Trehane	£3,400	W. H. Stephens.....	£2,924
W. J. Winn	3,075	John Colliver, Truro*....	2,912
James Julian.....	2,930		

* Accepted.
[Architect's estimate, £3,250.]

CROYDON.—For the repair of Wellington-road, Croydon, and Whitworth-road, South Norwood, for the Town Council:—

Wellington-road.

H. Lake	£256 13 11
A. Bullock, Croydon (accepted)	252 0 0

Whitworth-road.

W. H. Wheeler	£489 0 0
A. Bullock	450 11 4½
H. Lake, Croydon (accepted)	433 5 10

DURHAM.—Accepted for alterations to Wesleyan Chapel, Woodland:—
John Kidd & Son, Cows Hill, Weardale..... £129 10 0

INVERNESS.—For the restoration of Lovat or Beauly Bridge. Mr. C. R. Manners, engineer, 12, Lombard-street, Inverness, N.B.:—

Contract No 1.—Sheet Piling.

Henderson & Duncan ..£2,100	0	C. R. Brebner	£1,420 0
T. Macdonald 1,750	0	T. Macdonald, Inverness (accepted)	1,247 4
R. Fraser 1,700	0		

Contract No 2.—Masonry, &c.

Henderson & Duncan ..£6,000	0	T. Macdonald, Inverness (accepted)	£3,649 7
R. Fraser 4,130	0	T. Macdonald.....	3,399 0

KENLEY (Surrey).—Accepted for the erection of gardener's cottage and alterations to stables at Oak Lodge, for Mrs. Groome. Mr. R. M. D. Lucas, architect, Southampton:—
J. Monger £103 0 0

LEAVESDEN (Herts).—For erecting an isolation block at the St. Pancras Schools, Leavesden, Herts, for the Guardians of the Poor of St. Pancras. Messrs. A. & C. Harston, architects, 15, Leadenhall-street, E.C. Quantities by Messrs. Corderoy & Selby and Mr. W. T. Farthing:—

Reed, Blight, & Co. £5,707		Leslie & Co.	£4,280
W. H. Lascelles & Co.....	4,997	C. Miskin	4,150
W. Johnson & Co., Ltd. ..	4,507	Thos. Turner, Ltd.*	3,931

* Accepted.

LEICESTER.—For erecting two villa residences, Narborough-road, Leicester. Mr. Frank Seale, architect, 31, Belvoir-street, Leicester. Quantities by the architect:—

J. O. Jewsbury £2,268		T. & H. Herbert £2,175	
T. Richardson & Son.....	2,228	J. E. Johnson.....	2,169
J. Masons & Sons.....	2,190	John Hutchinson & Son	2,158
Wm. Gimson & Sons	2,190		

[All of Leicester.]

LITTLE BOOKHAM.—Accepted for new farm buildings, &c., at the Manor Farm, for Sir Francis Boileau, Bart. Mr. William J. Shearburn, architect, Effingham House, Arundel-street, Strand:—
Hamblin Bros. £535 0 0

LONDON.—Accepted for the erection of tower, porch, vestibule, colonnade, narthex, &c., at the Church of the Servite Fathers, or Servants of Mary, South Kensington, for the Very Rev. Prior Appolloni, O.S.M. Mr. Joseph Stanislaus Hansom, architect, 27, Alfred Place West, South Kensington:—
Mr. George Porter, sculptor..... £4,804

LONDON.—For rebuilding the "Queen Adelaide" public-house, Hackney-road, N.E., for Messrs. Chandler & Co. Mr. Fred. A. Ashton, architect, 3, Crooked-lane, E.C.:—

A. Reed & Son £2,684		W. Shurmur.....	£2,484
Hearle & Farrow	2,510	J. & H. Cocks.....	2,326
W. Watson	2,494	Coulsell Bros.	1,976

Fittings.

W. Shurmur	£729	J. & H. Cocks.....	£659
W. Watson	696	A. Reed & Son	639
Hearle & Farrow	675	Coulsell Bros.	567

LONDON.—For erecting first portion of St. Mark's Church, Forest Gate, E., for the Rev. J. S. Elphick. Mr. E. P. Loftus Brock, architect, 36, Great Russell-street, W.C.:—

Perry & Co.	£1,646	Reed & Son	£1,451
Gregar & Son	1,597	Dorrell & Co.	1,400
Mattock Brothers	1,547	Watson	1,397
Thomas Nye.....	1,470	J. Allen & Son.....	1,365

LONDON.—Accepted for building five shops on land adjoining Bath-house, High-street, Lewisham. Mr. Albert L. Guy, architect, 78, High-street, Lewisham:—
D. & R. Kennard, Lewisham-bridge £3,200 0 0

LONDON.—Accepted for the erection of two shops on the Brook House-estate, High-street, Lewisham, for Mr. E. Mac. F. Patterson. Mr. Albert L. Guy, architect, 78, High-street, Lewisham:—
D. & R. Kennard, Lewisham-bridge £1,600 0 0

LONDON.—For pulling-down and rebuilding "The Anchor" beer-house, Lewisham-road, S.E., for Messrs. Whitbread & Co., Lim. Mr. Albert L. Guy, architect, 78, High-street, Lewisham:—

Messrs. Worsley	£1,546	Courtney & Fairbairn	£1,167
Godfrey & Sons	1,497	Kennard, Lewisham-bridge*	1,100
S. J. Jerrard.....	1,487		
Soper	1,441		

* Accepted.

LONDON.—For new lead roofs, drainage, and sanitary works, &c., at 3, Wilton-place, S.W. Messrs. Christopher & White, architects:—

Foxley £375		Bulman & Dales.....£344	
Myring 348			

LONDON.—Accepted for certain alterations and additions to the "Plough and Harrow" beer-house, Catford, for Mr. Vernon. Mr. Mr. Albert L. Guy, architect, 78, High-street, Lewisham:—
D. & R. Kennard, Lewisham Bridge £300 0 0

LONDON.—Accepted for retaining wall to the River Ravensbourne, in the rear of the "Tiger's Head" public-house, Southend by Catford, S.E., for Messrs. Whitbread & Co., Limited. Mr. Albert L. Guy, architect and surveyor, 78, High-street, Lewisham:—
J. Woodham, Holmshaw-road, Sydenham..... £199 0 0

LONDON.—Accepted for fitting and finishing shop at Catford Bridge, for the Forest Hill Meat Co. Mr. Albert L. Guy, architect, 78, High-street, Lewisham:—
J. O. Richardson, Peckham £300 0 0

LONDON.—Accepted for alterations to the infirmary at Redhill Workhouse, Edgware, for the Hendon Union Guardians. Mr. C. A. Woodbridge, architect, Pinner House, Pinner:—
Gullett Bros., Wealdstone, Harrow £297 15 0

LOSTWITHIEL.—For the erection of a bridge and other works across the river Fowey, Nainsford, for the Trecangate Highway Board. Mr. W. R. Stevens, Surveyor, Mount, Warleggan, Lostwithiel, Cornwall:—

G. Harris, Liskeard.....	£224	10	0
J. D. Hobbs, Rilla Mill, Callington (accepted)....	108	0	0

NEW BROMPTON (Kent).—For the erection of cottage, office stables, and store, Bridge-road, for Messrs. Rigden. Mr. H. B. Wilson, architect and surveyor, Canterbury:—

Beaumont £895		Seager £689	
Goldfinch..... 798		Hammond, New Brompton* 650	
Snow..... 750		Harris † 595	

* Accepted. † Withdrawn.

RUSHDEN (Northamptonshire).—For the construction of wells, engine-house, and cottage, covered service reservoir, for the Local Board. Mr. Reginald E. Middleton, engineer, 17, Victoria-street, London, S.W.:—

Siddons & Freeman	£7,590	Smith & Sons	£6,150
S. Hipwell	7,100	T. Smart	6,144
Hughes & Gotto	6,777	H. Shardlow, Nottingham*	5,730

* Accepted.

SANDWICH (Kent).—For the erection of cottage, stables, coach-house, &c., at the "Cinque Ports Arms," for Messrs. Rigden. Mr. H. B. Wilson, surveyor, Canterbury:—

Paramor & Son	£795 0 0	Newby Bros.	£727 12 0
Wise	795 0 0	Denne & Son, Deal*	715 0 0

* Accepted.

WANSTEAD.—For the erection and fitting-up of the "Lord Rookwood" public-house, Cann Hall-road, Wanstead, E., for Mr. Chas. Wm. Emery. Mr. Fred. A. Ashton, architect, 3, Crooked-lane, E.C.:—

W. Shurmur	£4,320	J. & H. Cocks	£4,088
A. Reed & Son	4,296	F. Voller	3,985
W. Watson	4,275	Hearle & Farrow*	3,924

*Accepted.

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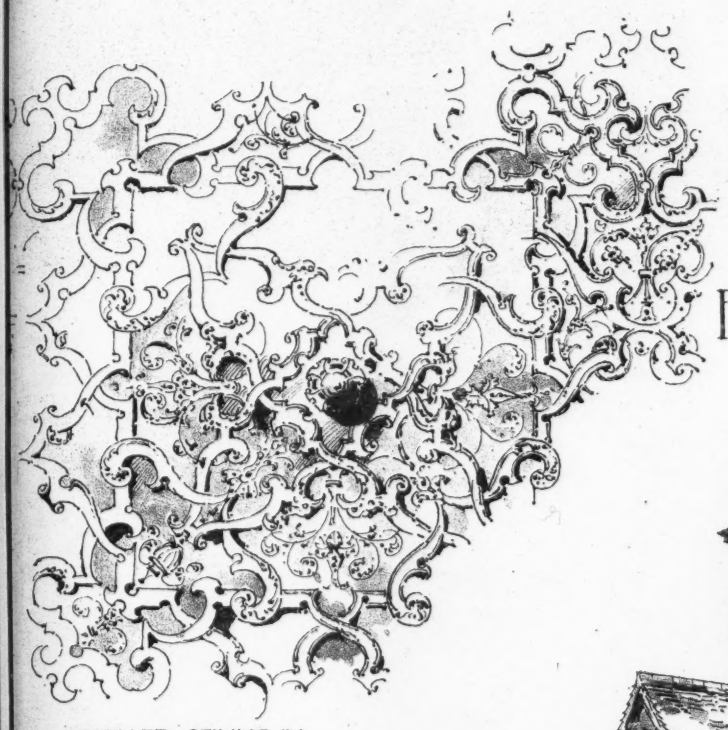
Royal Academy Exhibition, 1893.

An Architect's Home: Grove Hill Cottage Harrow-on-the-Hill



MODELLED CEILING IN THE DRAWING ROOM

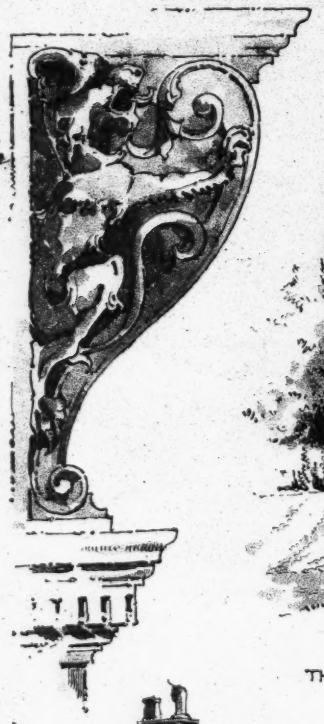
MANTEL IN DINING ROOM

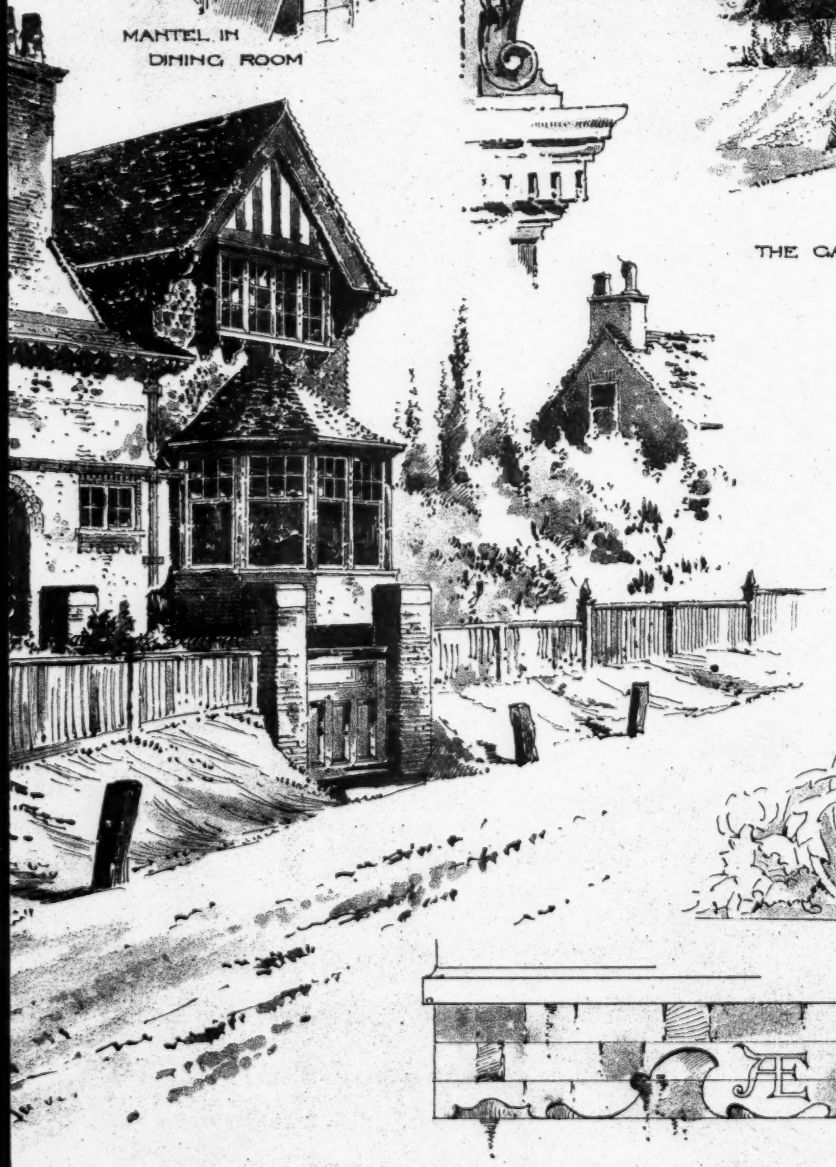
ENTRANCE FRONT

TILES IN THE DRAWING ROOM E.M.D.

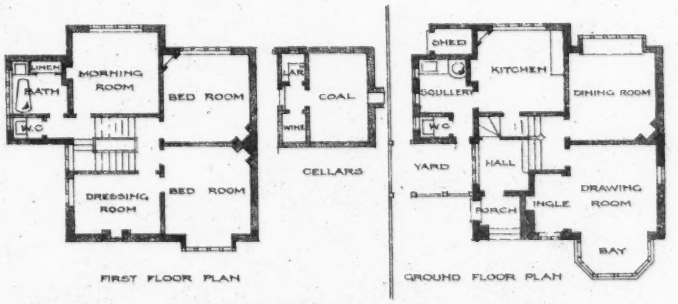
Royal Academy Exhibition, 1893.

MANTEL IN DINING ROOM





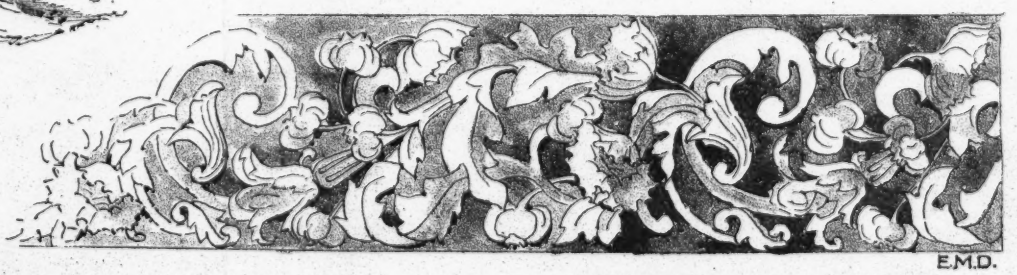
THE GARDEN FRONT



FIRST FLOOR PLAN

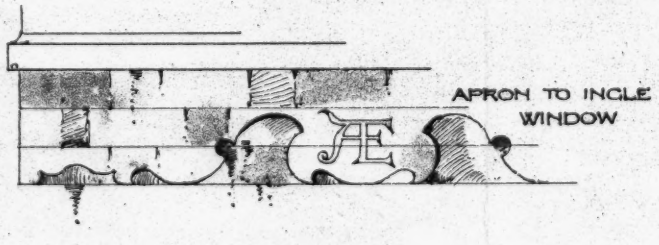
GROUND FLOOR PLAN

KEY PLANS



E.M.D.

COLOURED FRIEZE IN DRAWING ROOM



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Arnold Mitchell
Architect
16 Finsbury Circus. E.C.

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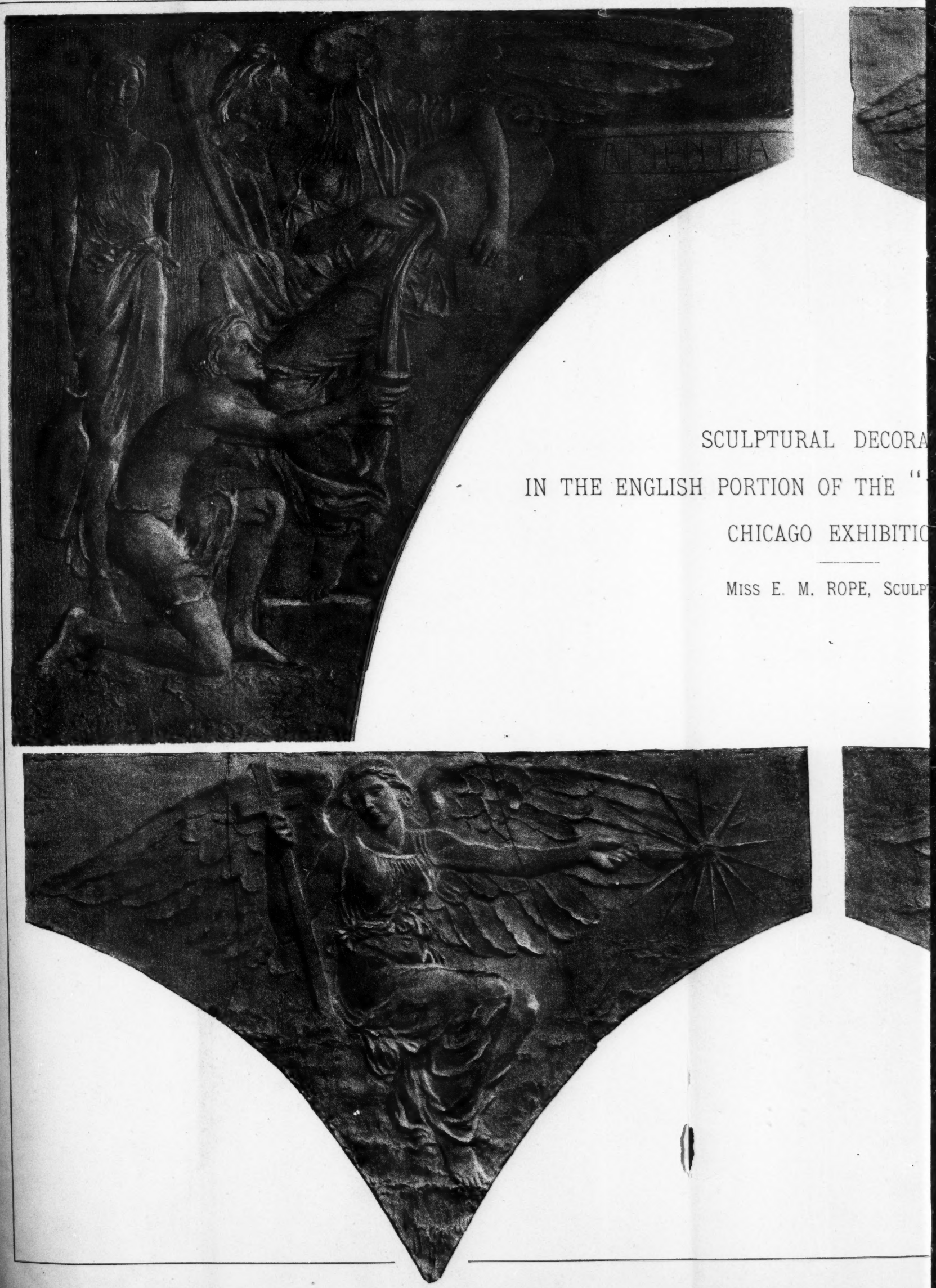

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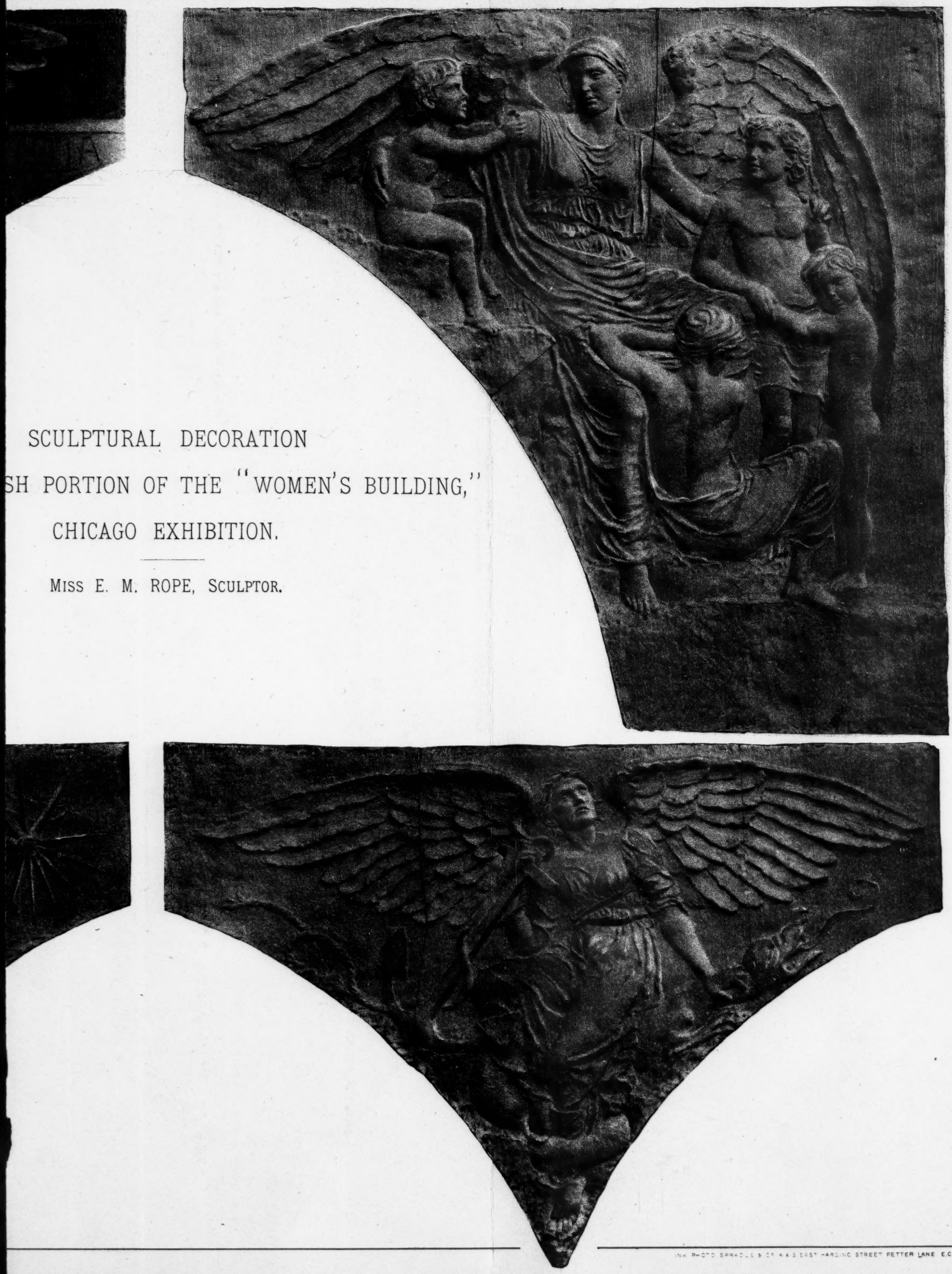
CHICAGO EXHIBITIC

MISS E. M. ROPE, SCULP



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MISS E. M. ROPE, SCULPTOR.

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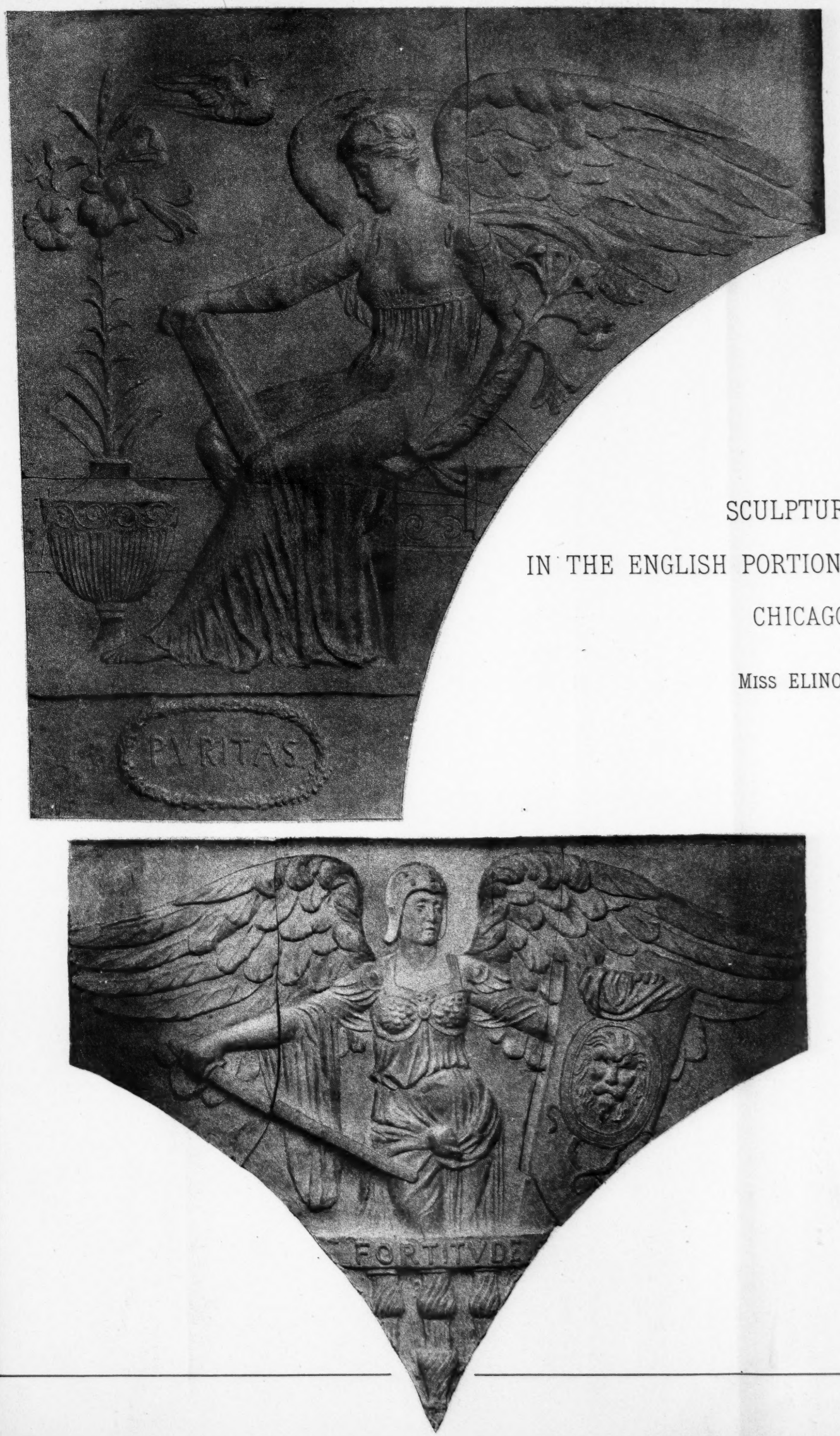

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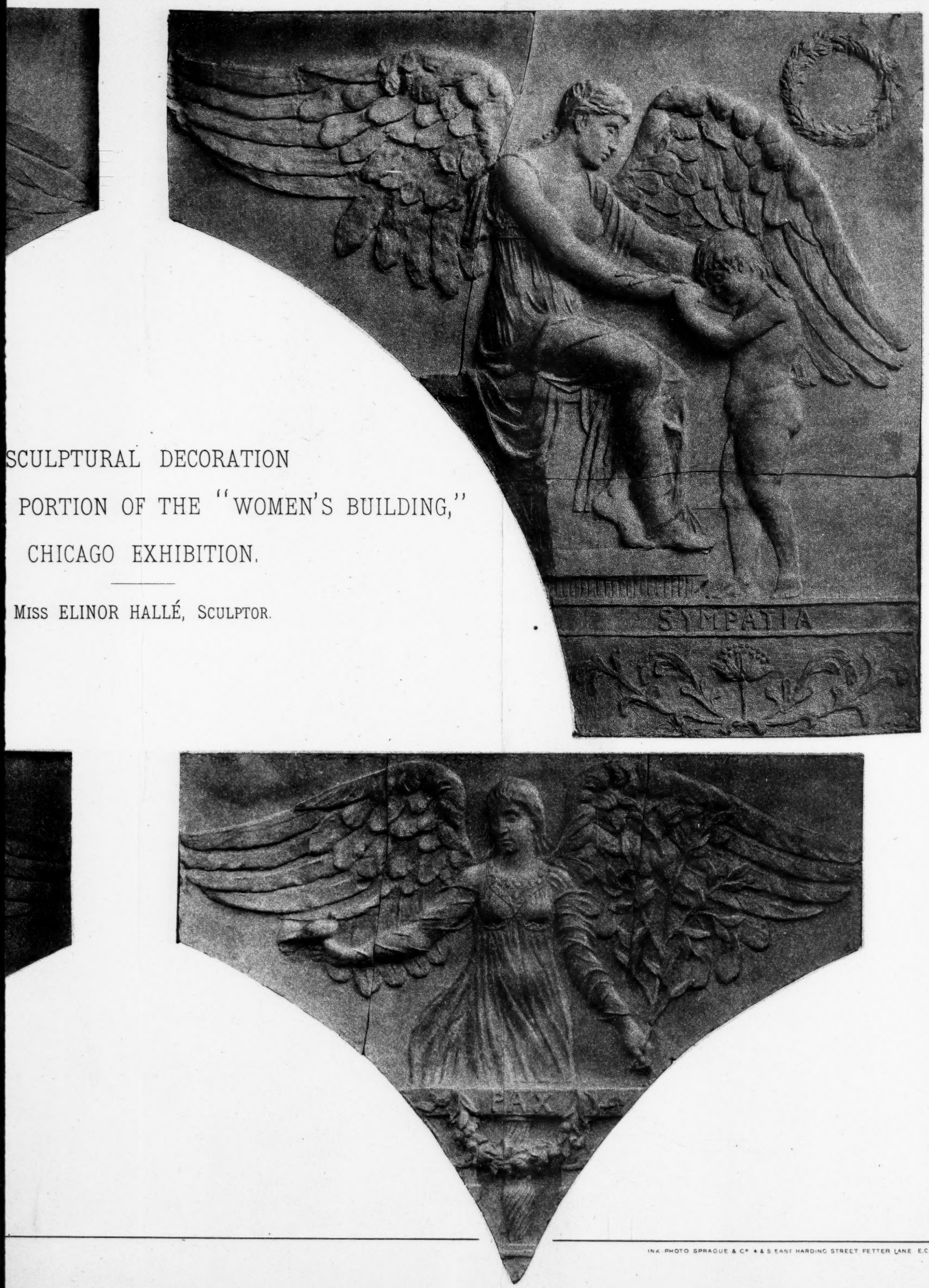
CHICAGO EXHIBITION

MISS ELINOR HALLÉ, SCULPT



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